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France's Sahara Bill

EXPLOITATION of the vast natural resources underlying the Sahara Desert is one of the foundations of France's economic policy. Account has to be taken, however, of the susceptibilities of local populations, in both North and West Africa, who suspect that France is endeavouring to despoil them of their mineral heritage. The French government seeks to achieve the unity of control necessary for rational exploitation of the Sahara's minerals without treading on the sensitive corns of national aspirations.

In order to achieve this aim the government proposes to set up a central authority to be known as the Joint Organization of Saharan Regions. Its creation was approved by the French National Assembly on December 14 by 316 votes to 162. It has now been approved by the Council of the Republic (the French Upper House), which, however, maintained 10 of 54 amendments proposed during an all-night debate on the Bill.

The Joint Organization which is likely to be created early in 1957, will co-ordinate the economic development of 3,600,000 sq. kilometres of sparsely inhabited desert regions at present administratively attached to Algeria, part of Metropolitan France, and French West and Equatorial Africa. It is intended to provide the necessary unity of control for economic development and will also be responsible for defence, but will have no political or administrative powers.

The area to be controlled by the Joint Organization embraces Southern Algeria, territory lying south of newly-independent Morocco and Tunisia, and another strip of desert territory to the south extending from Dakar in Senegal to Fort Lamy in the Tchad. The region is bordered to the south by the French possessions of Senegal, French Sudan, Niger and Tchad, on the west by Morocco and on the east by Libya and the Sudan.

At the head of the Joint Organization will be a delegate-general, whose status will be similar to that of a governor-general. He will be advised by a commission of control, which will draw half its members from the French Parliament, the Assembly of the French Union, and the Economic Council, the other half being representatives of the various African territories. There will also be a small management committee composed of high officials appointed mainly by the French government, which will assist the delegate-general. The Joint Organization is empowered to negotiate within its own sphere with international bodies or foreign states.

The Sahara's known mineral resources include rich deposits of oil, natural gas, iron, coal and copper. Tin, manganese and chromium have been discovered in considerable quantities in various parts of the desert, and there is also uranium.

It is evident that to undertake the large-scale development of mineral deposits situated hundreds of miles apart, and to provide reasonable living conditions for workers in the inhospitable hinterland of the Sahara desert, an immense capital expenditure will be required. Purely tentative figures have been put forward, which indicate that an investment of 150,000,000,000 francs would be

needed for a possible annual production of 10,000,000 tons of oil and a daily output of 4,000,000 cu. m. of natural gas.

Clearly the foremost requirement is to provide a climate favourable for the investment of risk capital on a scale commensurate with the magnitude of the undertakings. From this standpoint alone the restoration of peace in Algeria and the willing co-operation of the two former Protectorates of Morocco and Tunisia are essential.

Though the French government's Bill is essentially a compromise measure designed to co-ordinate economic development without detriment to political and administrative independence, the scheme met with an unfavourable reception in various quarters, as was indicated by the large adverse vote in the French National Assembly. The most notable opposition in the Assembly came from the Senegalese deputy, but French settlers in Algeria and Morocco have also shown marked hostility to the establishment of the Joint Organization.

The immediate problem is to dispel the existing undercurrents of distrust and persuade the territories concerned that they have much to gain, and nothing whatever to lose, from a scheme which has no political implications.

HAITI'S MINERAL DEPOSITS

The Republic of Haiti occupies the western third of the second largest island in the West Indies, which it shares with the Dominican Republic. It is slightly smaller than Belgium, having an area of 10,700 square miles.

Until quite recently it was considered that Haiti had no deposits of minerals in commercial quantities. Although copper had been mined in the Terre Nueve area as early as 1728, it had never been exploited during the recent history of the country and other minerals have never been exploited at all.

Haiti has now come into the world picture as a potential source of bauxite for the expansion of aluminium production. Reynolds Metals is actively engaged in the development of the Republic's bauxite resources, which are also being studied by Kaiser Aluminium. It was reported recently that the activities of U.S. aluminium producers might lead to the establishment of a mining industry with an output worth many millions of dollars a year.

This prospect lends additional interest to the brief description of the Republic's mineral resources, which occurs in the latest economic survey of Haiti, written by S. Simmonds, O.B.E., H.M. Ambassador and Consul-General at the British Embassy in Port-au-Prince. This review has been published for the Board of Trade by H.M.S.O., from whom copies are obtainable. The price is 2s. 6d. (by post 2s. 8d.).

It was not until 1943, when the Reynolds Mining Corporation correlated reports on alumina discoveries in the red soil of Manchester in Jamaica and a U.S. Geological Survey report on similar soil in Haiti, that serious exploration for bauxite deposits was undertaken. Bauxite was found in large quantities in the St. Croix area, near Miragoane, as well as in several other parts of the country. The St. Croix deposits were the only ones which seemed to have commercial quantities worth exploiting, when considered in conjunction with the transport and shipping facilities available or possible. These deposits are estimated at approximately 10,000,000 tons of Grade B ore, or enough for 33 years of extraction by bulldozers and/or drag lines at the rate envisaged. Reynolds have a contract

with the Haitian government and have already built a complete harbour with a processing plant just outside Miragoane. They have made a 20-kilometre stretch of four-lane highway to the mining area and have built staff houses and a clinic. The export of alumina is scheduled to start in March, 1957.

The Consolidated Halliwell Mining Co. of Canada has obtained a contract with the Haitian government through its local affiliate, the Société d'Exploitation et de Développement des Ressources Economiques et Naturelles (SEDREN) for the exploitation of copper at Terre Nueve and the surrounding district. It is actively engaged in preparing the site for production, which, according to the terms of the contract, must be started in two years. According to a Toronto newspaper, the deposits have copper values running from 1.12 to 6.94 per cent. The contract covers an area of 100 sq. miles of the middle and northern part of Haiti.

Lignite has been found in the area of Maissade and the SEDREN has a contract for 35 years to cover exploration and production.

The Commonwealth Oil Co. S.A. has been drilling on the island of Gonave for nearly two years without results. Some years ago the Atlantic Refining Co. made test drills in the Central Plain and near St. Marc, but no oil was found.

The government controls mining through the Bureau des Mines, a department of the Department of Public Works, from which permits to search for and exploit minerals must be obtained. The Decree Law of 1943, which set up the Bureau des Mines, also defines the State's right to expropriate private property for the purpose of exploiting mineral deposits.

NEW YEAR LOOK FOR U.S. URANIUM

An official of A.E.C. states that contracts for five new mills were signed during 1956 and it was expected that the total would reach twelve or more by the end of the year. Heretofore, the emphasis has been toward mine development rather than toward treatment plants with the result that a large amount of ore has been accumulated in stockpiles. Much of this has been from numerous areas of limited production but of late there has been a trend toward developing and mining larger deposits and integrating others. This has brought about a change from many small mills handling custom ores to larger plants built to service a controlled ore supply. Typical of the latter is the deal that Hidden Splendor Mining Co., a subsidiary of Atlas Corporation, has made in acquiring a 30 per cent interest in Uranium Reduction Co., a Charles Steen affiliate, which is building an \$8,500,000 concentrator at Moab, Utah. With this facility available, Atlas has abandoned plans to build a 2,000 tpd plant at La Sal, Utah. Included in the agreement is a provision that Atlas will finance to the extent of \$2,500,000 the installation of a carbonate leaching circuit in the mill now building. The companies involved control, either by ownership or contract, all but one of the major ore bodies in the Big Indian district, one of the largest in the country. The deal solves a rather complex problem which seemed to be rising in this district and will bring mine production and mill capacity fairly well into balance.

Prior to 1954 a 300 tpd mill was about the largest in operation but now there is only one of that limited capacity, four are in excess of 500 tons with at least five of a capacity of 1,000 tons or more in the planning stage. A

uranium mill is not a cheap proposition. A.E.C. released some estimates lately to the effect that capital cost of a 200 tpd mill approximates \$10,000 per daily ton, but a 2,000 ton mill can be built for one-half of that unit cost. Milling costs run from \$11 to \$16 per ton in a small mill to \$6 to \$8 on a 2,000 tpd basis. With experience gained efficiency has been stepped up from about 80 per cent to nearly 90 per cent.

While the number of shipping properties decreased in the first half of 1956 as compared with the last half of 1955, output of ore was increased. Present rate of production is estimated at 3,000,000 tons per year with a prospect that this may be increased in the future to 5,000,000 to 6,000,000 tons. Reserves in producing areas are placed at 30,000,000 tons with a like amount of inferred or indicated tonnage.

The Ambrosia Lake field still holds the centre of interest. Phillips Petroleum Co. reports blocking out 1,500,000 tons of better than average grade ore on a 1,280 acre lease, with a portion still to be explored.

Homestake Mining Co. has entered into an agreement with United Western and Rio de Oro to negotiate a contract with A.E.C. for a 750 ton mill in the district. The mill will treat the ores of the associated companies and also of a new mine that Homestake is developing. While such estimates are doubtless premature the opinion has been advanced that the Ambrosia Lake district contains three times as much ore as all of the other fields so far developed.

COAL PIPELINES

Following the completion of the first U.S. coal pipeline, comes the suggestion from the National Coal Association that America may ultimately have a coal pipeline network similar to the existing natural gas trunk pipe system. Development will depend upon the comparative economics of this form of haulage with shipment of coal by water or rail. In theory there is no major technical obstacle to the project, but first of all, the completed installation will be closely studied both from the financial and the engineering aspects. This prototype installation will carry coal from Cadiz, Ohio, to the industrial city of Cleveland, a distance of some 110 miles. Approximately 1,300,000 tons of crushed coal will be carried annually through the pipeline at a speed of 4 m.p.h.

A report issued by the N.C.A. suggests that other pipelines could be constructed to form a network linking the mining areas of West Virginia, Ohio and Pennsylvania with customers in the Middle West and the East Coast.

Coal transport also figures prominently on the international scene. Because of the pressure on shipping occasioned by the closure of the Suez Canal and the delays incidental to securing the release of ships of the U.S. mothball fleet, shortage of shipping space is limiting supplies of coal to Europe. Latest official figures show that 112 ships have been released from the U.S. reserve fleet since August. This number includes 30 ships released to the newly formed American Coal Shipping Inc. Coal exporters in America are of course eager to be on the band wagon and more than 100 applications from coal transporters have been received for former Liberty ships.

The shortage of coal cargo vessels has of course pushed up the freight rates and an all-time peak rate of 119s. 6d. was paid recently by French Charterers. Since then the British National Coal Board have obtained tonnage for single voyages from Hampton Roads to Antwerp at 107s.

per ton, and it is expected that rates will drop soon to around 100s.

In Europe the six Pool countries will require an additional 6,000,000 tons of coal this year as a result of the blockage of the Suez Canal. This will presumably have to come from the U.S., as at a recent meeting between representatives of the U.K. government and the E.C.S.C. it was decided that Britain could not increase exports of coal to Europe. Even without the Suez Canal complications the Pool countries had during last year been steadily stepping up the purchase of U.S. coal. In the first quarter imports totalled 5,900,000 tons, in the second quarter 6,800,000 tons and in the third quarter 8,600,000 tons. It was estimated that imports would total 10,000,000 tons in the final quarter. This total of 31,000,000 tons is 7,000,000 tons more than the 1955 estimate of how much would be required during last year. The High Authority, however, are confident that the cut in fuel-oil supply brought about by the closure of the Suez Canal can largely be made good with additional imports of American coal.

URANIUM BY THE POUND

Britain has agreed to buy any radioactive minerals found in Southern Rhodesia at a very advantageous price, according to a recent announcement by Mr. C. J. Hatty, the Colony's Minister of Mines. Mr. Hatty was addressing a gathering of would-be prospectors at the opening of a lecture course at the National Museum, Bulawayo.

"We have negotiated an arrangement with the United Kingdom Atomic Energy Authority whereby there will be a very advantageous buying scheme for small lots of radioactive material," he said. "It is not a myth that we have radioactive material in Southern Rhodesia. We have quite recently made a find in almost fairy-story fashion. It was a week-end prospector with a Geiger counter who found radioactive material in the finest form of all—pitchblende. We don't know whether it is worth developing but it indicates that it exists."

The Minister emphasized that, despite the tendency for the small workings of the past to give place to undertakings depending for their economics on large-scale operations backed by huge concentrations of capital, prospecting still remained very largely a personal matter. It had been proved that the individual prospector doing his work thoroughly on a small area of land could find answers that escaped the larger enterprises.

To encourage prospectors throughout the Federation to concentrate on the search for radioactive minerals—and to persuade others to enter the field—the United Kingdom Atomic Energy Authority is prepared to accept much smaller amounts of minerals than previously and will pay a better price. Full details of the scheme have not been released, but a spokesman for the Authority in Salisbury, Mr. K. C. Branscombe, said in October, 1956, that the price to be offered would make this form of prospecting one of the most lucrative in the Federation. Previously the U.K.A.E.A. had been prepared to accept only substantial quantities of the mineral on the understanding that they would be delivered at the ports at the seller's expense. It would have a buying agency in the Federation, and the Authority would refund part of the freight charges incurred by prospectors, providing their material was suitable. The agency would be prepared to buy in small quantities, depending on the amount of uranium in the rock. The scheme would be restricted to uranium, although the Authority might consider buying limited quantities of thorium.



Mining at Kristineberg, North Sweden

The work of planning for the commercial exploitation of the Kristineberg mine began in 1937 and in December the Board of the Boliden Mining Company decided to allocate funds for it. The crushing plant was put into operation on the 2nd August, 1940, and the concentrating plant on the 10th October. The mine produces approximately 300,000 tons of ore a year, mainly from underground operations.

THE Kristineberg deposit is situated in a large area of sericite and chlorite-bearing supra-crustal formations in the western part of a dome-like granite massif. The strike of the deposit is mainly from east to west, and the dip varies between 45 deg. and 60 deg. to the south.

The deposit includes two parallels situated about 130 m. from each other. The northern parallel is mainly composed of five uniform ore bodies. The central ore (A-ore) consists of cupriferous pyrite and zinc blende with lead glance in minor quantity, while the outer ore bodies to the east and west entirely consist of iron pyrites. The southern parallel (the B-ores) includes one large and two small lenses and consists of iron pyrites with copper pyrites frequently occurring as hard ore.

Open cast operations are carried out where certain residual portions from the earlier milling operations down to about 60 m. from the surface are being excavated. The work in the open cast principally comprises benching of gangue in the hanging wall of the A-ore. The gangue is used as mine fill,

Major Production is Underground

The major part of the production in the Kristineberg mine consists of ore extracted below ground. The work can be characterized as longitudinal cut-and-fill mining, leaving pillars. The block height is 80 m., and the main levels are situated 90, 170, 250, 330, 410 and 490 m. below the surface. The lowest level on which mining is at present in progress is the 330 m. level.

All pillars are 5 m. in width, the distance between them ranging from 20 to 55 m. The shorter distance is used where the hanging wall consists of talc-bearing chlorite slate of very poor strength (A-ore). Where the hanging wall consists of solid sericite or chlorite-quartzite the largest pillar distances are used. In such workings the rock fill raise is always arranged unsymmetrically to make it possible to divide the operations, if necessary, into two smaller workings by leaving a pillar in the middle.

After the approximate position of an ore body has been localized by geographical observations and diamond drilling, an exploratory gallery, 2.2 x 2 m. is driven in the direction of the strike. From this gallery a diamond hole is drilled cross-wise through the ore for every 20 m., partly to localize the ore

Opposite: A 16 ton electric haulage train, designed by the Boliden Mining Company, hauling a 175 cu. ft. bogie car of the Granby type at Kristineberg

Below: The skip station at Kristineberg's 1600 ft. level

limits, partly to obtain chemical analyses for the preparation of analytical maps.

In thin ore bodies the exploratory gallery is driven along the footwall and then stoped out to full haulage drift size, i.e. 2.6 by 3.0 metres. From the gallery, chutes and manways are then driven to each working, the bottom slice of which is stoped out 7 m. above the floor. After a fill raise has been driven along the hanging wall to the superincumbent main level, mining can be started.

In thick ore bodies the exploratory gallery is driven along the hanging wall, after which a special haulage drift is driven to full size in the footwall. In this case the chutes are driven from the footwall drift, while the manways are driven from the hanging wall drift.

Overhand Stopping Practice

The cut-and-fill method is undertaken by overhand stopping, the slices being 2.6 by 3.5 m. in height. The ore is removed by means of 3-drum scrapers (about 30 h.p.), after which gathering raises with two timbered walls are built in the corners between the pillar and the footwall. A manway is built on the top of the gathering raise. Each working thus has 2 manways and 2 gathering raises with the exception of the short workings (20-25 m.) which have only one gathering raise. When the timbering has been completed, the working is filled to within about 2 m. of the roof, and the fill is levelled by means of the scraper. The floor is covered by 10-mm. plates, 3 x 1 m. in size, after which the working is in order for stopping the next roof block.

In certain large workings with solid hanging walls and ore roofs, overhand stopping is effected by short delay blasting of parallel upholes having an inclination of about 70 deg. To strengthen the hanging walls, roof bolting by means of cotter bolts is extensively practised. The filling material used is partly gangue from the hanging walls of the open cuts, partly gravel. In the future all gangue will be crushed in a central crushing mill 90 m. below the surface before being distributed as fill. The crusher is a Morgardshammar boulder crusher Type AR 150.

On each level ore is hauled from the superincumbent working and rock fill distributed to the underlying workings. The main haulage drifts are 2.8 x 3.3 m. in size. The very corrosive pit water (pH 2.3 x 3.0) makes efficient draining of the drifts necessary. The rail track is therefore placed on a bed of coarse gravel 30 cm. above the floor of the drift, and a 40-cm. water ditch is cut. For foot-passenger traffic an 80-cm. gravel walk is provided. The pipe lines are carried by cotters in the wall of the drift, making them easily accessible for repair and maintenance.

From year to year increasingly large haulage car units have been developed. On the 330 m. level 5-cu.m. bogie cars of the Granby type are at present used. Each train consists of 6 cars, having a capacity of about 12 tons of ore each. The locomotive is an electric contact locomotive of the Boliden Company's own manufacture. It weighs 16 tons and has a total motor output of 60 kw. The brush is of the trolley type, simplifying the running of the locomotive line at the chutes. The cars are dumped by means of a pneumatic cylinder.

The large-sized cars make it possible to use large chutes, 2 x 1.2 m. in size, which are operated by means of a pneumatic cylinder.

Crushing and Hoisting

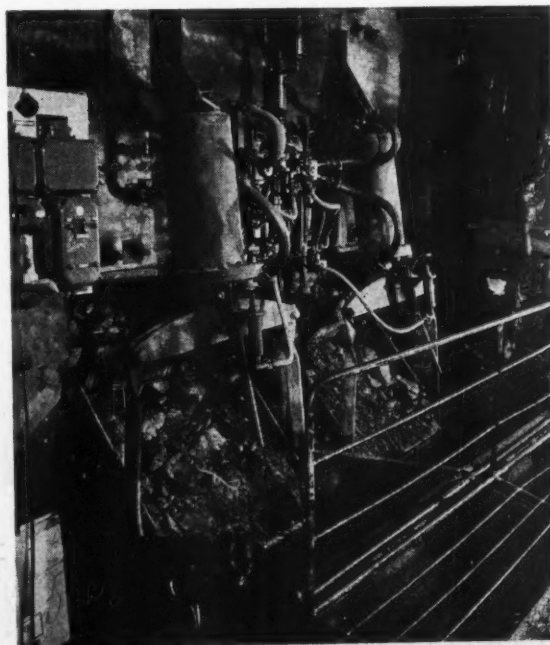
There are two communication shafts, each driven to a depth of about 520 m. The ore on the upper haulage levels is dumped into a system of chutes close to the central shaft. The chutes from the upper levels terminate in a crushing station 410 m. below the surface. In this station the ore is chuted direct into a Morgardshammar coarse crusher No. 10. Under the crushing station there are two ore bunkers. Above the 490 m. level these bunkers open out into a collecting bunker from which the ore is chuted by means of 1 m. air-operated chutes into the skip bunkers.

The ore from the Rudtjebacken and the Ravliden field mines (totalling about 300,000 tons a year) is transported to Kristineberg by motor lorries and dumped into 3 special lorry bunkers emerging into a skip station immediately above the 90 m. level. From this station the ores are hauled via the central shaft of the Kristineberg mine to the crushing mill.

The ore is raised by means of an alternating current driven Koepe hoist with two skips arranged for bottom drainage. For passenger and material transport a Koepe hoist with Leonard-operated direct-current motor is provided. It is equipped with a counterweight and is normally operated from the hoist cage by means of a hand wheel or a push-button system. The passenger hoist is also used to some extent for raising gangue from development and exploratory drifts. The gangue is then transported by small square cars to the 90 m. level where it is distributed as fill.

The gangue taken out in connection with drifting on the 330 m. level and the lower levels is chuted from bunkers close to the previous prospecting shaft direct into a rope-guided barrel in this shaft.

The present production of the Kristineberg mine amounts to about 300,000 tons of ore a year. Output amounts to about 10 tons of broken ore per manshift (below ground) and about 45 tons per cut-and-fill worker. The mine employs 438 workers, of whom 133 are underground personnel.



AN attractive method of cutting and loading for use in the thinner seams is to use standard machines such as the A.B. fifteen, M and C Sampson, or B.J.D. Ace longwall coal cutters, with which the labour is already familiar, to cut and, with slight modification, to load. Loading may be carried out by the same machine fitted with flights attached to the cutting chain and a back spillage plate for the return journey, or if the coal can be readily prepared for loading without shotfiring separate machines may be used to cut and load the coal, the loading machine following the cutter at a distance depending upon the behaviour of the cut coal. In this case a fairly shallow web of coal is taken, say 2 ft. 6 in.

When loading, the machine travels jib first with the jib locked at a leading angle relative to the direction of travel of the machine which is dependent upon the nature of the coal angle of face and cleat, etc. The spillage plate behind the jib ploughs forward any loose coal left behind by the loading flights. For single machine operation a web of, say, 5 ft. may be taken. Holings from the undercut is cleared by a gumstower. The coal is prepared for loading whilst the machine is turned and prepared for loading back.

The practice of cutting out an entire seam of 2 ft. 6 in. down to 1 ft. 10 in. by means of multi-jib coal cutters has developed recently, particularly in seams of industrial or coking coals.

By J. M. CAW

For two machine operation the roof parting should be sharp and the coal must sit down a few yards behind the cutter. The undercut is cleared by the gummer attached to the front machine in order to facilitate this. A mushroom jib or curved jib can be used to shear to a height of 2 ft. at the back of the cut, to ensure the collapse of the coal behind the cutter. Twin loading jibs can be used, one fitted with cutting picks and the other with loading flights, to give good coal preparation. Cutting and loading machines will usually travel about 20 yards apart, the twin jib of the loader being fixed at a leading angle of about 45 deg. A full rate of travel of about 4 ft. 6 in. per min. can be maintained with the A.B. machines.

The development of flight loading at Brookhill colliery in the Alfreton area of the East Midlands Division is des-

Cutting with Standard Machines

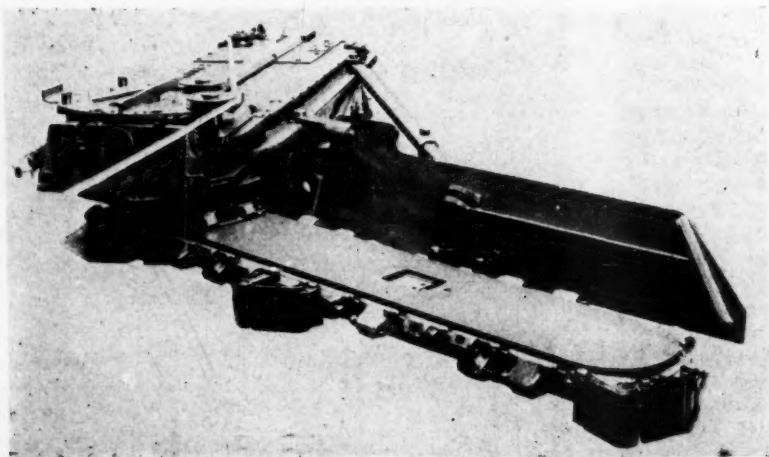
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cribed by Harley.¹⁰ Attempts to plough coal cut to loadable size in the 2 ft. 6 in. thick Piper seam showed that the increase in volume of the cut coal caused jamming of a static type plough and that a power-loader was necessary. A second A.B. 15 machine fitted with Lambton Flights was equipped to follow the cutter. After much experiment a mushroom jib cutting to a depth of 3 ft. 8 in. and with 17 in. mushrooms proved the most effective; 120 yards of face could be cut and loaded in 3½ hours, the remainder of the shift being spent in turning round, moving the conveyor, drawing the chocks forward and caving.

Results obtained during three typical months are shown in comparison with those obtained from a normal hand-got face :

	Output tons	Face O.M.S. Cwt.	Increased productivity Cwt.
Month 1	2,322	111.6	14.1
Month 2	2,166	113.1	19.5
Month 3	1,689	116.1	21.0

Burton and Rudge⁹ describe cutting and loading using a B.J.D. Ace machine with curved jib and later with dual jibs in the Parkgate seam of Denaby Main Colliery, North-Eastern Division. Although loading flights are not used this installation may be remarked here. The seam section varies between 4 ft. 2 in. and 5 ft. 6 in. and in general the coal parts readily from the roof. The machine was arranged to run on the panzer conveyor and raised on a 6 in. high ramp so that the downstepped type of curved jib used



Alongside is the A.B. fifteen longwall coal cutter fitted with A.B. loading flights. On the opposite page is shown, above, a section of A.B. dreadnought cutting chain fitted with A.B. loading flights, and below, details of A.B. loading flight showing flight, drop-in pins and special pick-holders

MECHANICAL CUTTING AND

LOADING IN COLLIERIES—IX

and Flight Loading

would cut at floor level to give easy loading of the cut coal, by hand, on to the conveyor.

The return journey is made without the ramp with the coal cutter chain running in reverse and a loading plate fitted and the bottom 6 in. of coal is cut and loaded. Tapered ends to the ramp facilitate positioning of the machine by means of the haulage rope. A face O.M.S. of 7 tons was obtained with single shift face working. This was maintained and improved with continued working on two shifts. The depth of cut used was 2 ft. 3 in. with a back shear of 1 ft. 9 in. and a 150 yds. face.

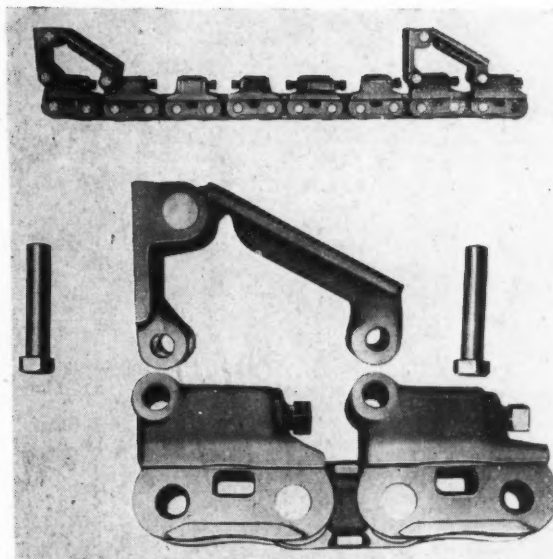
The article presented herewith, describing coal cutting in the United Kingdom by means of standard machines and flight loading, concludes our series on mechanical cutting and loading in British collieries.

On a second face 178 yds. long the depth of cut was increased to 2 ft. 5 in. and large coal necessitated the fitting of two jibs cutting 2 ft. 2 in. apart. Face O.M.S. between 7.8 and 8.5 were obtained.

The Huwood loading machine, designed for longwall work without the conveyor, works on the buttock end of the coal face and pushes coal on to a bottom belt conveyor by means of loading arms which rotate in unison at the base of the shot coal. The machine is hauled along the face, 25 yards at a time, by its own power. The loader is preceded by the cutter, which is fitted to leave a clean undercut and by shotfiring of the undercut coal. In order to obtain a clean undercut a mechanical gummer, supplemented by manual work with a long-handled shovel, is desirable. Two ropes are required to haul the loader.

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The capacity of the rope drums on the loading machine is about 30 yds. The rope laid at the back of the cut is, therefore, made up in 25 yd. lengths joined by shackles so that the rope already on the drum can be removed and the loader quickly reconnected. The main dimensions of the loader are as follows: Height 1 ft. 9 in., width 2 ft. 5 in. to 3 ft. 7 in. (dependent upon loading arm position), length (electric motor) 6 ft. 6 in. and weight 3,948 lb., length (compressed air turbine) 6 ft. 7 in. and weight 3,752 lb. The loader can be positioned by two men using their feet or by using the rope drums under power.

Harley¹⁰ gives a table comparing the coal sizes obtained for a hand-filled face and a Huwood power-loaded face:

Size in.	Huwood power- loaded face %	Hand-filled face %
Plus 6	9.6	29.7
6 — 3	10.0	13.6
3 — 2	7.7	8.6
2 — 1	15.3	13.5
1 — ½	16.9	10.0
½ — 0	48.5	24.6

An interesting application of this loader to work with a 19 in. Sampson longwall coalcutter, fitted with a Hoy-curved jib, is reported from North Gawber colliery, in the North-Eastern division. The cutter, which has a 4 ft. 6 in. curved jib cutting at floor level, is attached to the loader by a hinged plate, to provide articulated movement between the two units so that floor undulations can be easily negotiated. This is supplemented by a steel strap. The two outer loading flights on each side have been modified to assist in loading the coal without blasting. By the addition of extension pieces which can be detached and refixed to be on the side nearest the face, the flight clears right to the back of the cut.

The cutter-loader is working in the Top Haig Moor seam which is 3 ft. thick and lies at a depth of 370 yds., has a roof and floor of hard spavin. A double unit layout has been adopted with a face of 60 yds. on one side and 70 yds. on the other. The face is pre-cut at 4 to 6 in. from the roof. During a 5-day week 871 tons were loaded on to the face conveyor by the cutter-loader giving an O.M.S. of 6.8 tons, which compares with 5.1 tons on conventional units.



Inco's new mining area is here located in relation to the rest of Canada. Inco's Sudbury mining area is also shown

THE value of Canada's mine production has more than doubled since 1950, when it first reached \$1,000,000,000, and many observers believe that a period of further expansion lies ahead.

Canada is the world's leading producer of nickel, asbestos, calcium and nepheline syenite and possibly the platinum group metals; it is the second largest producer of aluminium, gold, zinc, titanium ore, magnesium, cobalt, cadmium and selenium. It is also likely to become the largest producer of uranium, which is headed for an annual output worth \$350,000,000-\$400,000,000.

During 1956 the most remarkable progress was made by copper, iron ore and uranium. Copper is now Canada's No. 1 metal in production value, with output for 1956 estimated at \$300,000,000. This gain is attributable partly to increased tonnage and partly to the higher copper price.

Increased production came mainly from the expansion programmes of Inco and Falconbridge Nickel in the Sudbury area; from the new mine of Gaspé Copper Mines in Gaspé, Quebec; and from the Chibougamau area, Quebec, now well on the way to becoming one of Canada's major copper-producing areas. Substantial new copper production is also on its way from the Manitouwadge area of Northwestern Ontario, where Geco Mines is spending \$20,000,000 to bring its copper-zinc property into production at a daily rate of 3,300 tons, and where Willroy Mines is planning production by the end of 1957. Several other producers in various parts of Canada are also being geared for production. By 1958, the Dominion's total annual output of this metal will be close to 420,000 tons.

Canada supplies 81 per cent of the free world's nickel. In 1955 it again smashed all production records with 176,000 tons out of the total free world output of 213,500 tons. Of the 1955 total, Inco accounted for 142,500 tons, Falconbridge Nickel for 21,000 tons, and Sherritt Gordon Mines for 8,500 tons. In addition, Inco refined 4,000 tons from Sherritt Gordon concentrates.

Future Canadian output promises to be augmented by that of such newcomers as North Rankin Nickel Mines, Eastern Mining and Smelting, Eastern Metals and others.

Canada Does it Again

The largest potential producers on the Canadian horizon, however, are Inco's two new nickel mines in the Mystery-Moak Lakes area, to be known as the Thompson and the Moak Mines, which will be the biggest nickel-producing operation in the world next to Inco's operations in the Sudbury district of Ontario. The project in Manitoba, together with the progress underway at Sudbury, will raise Inco's regular 1955 annual nickel-producing capacity by approximately 65,000 tons.

The value of Canada's uranium output approximately doubled in 1956, rising to an estimated \$50,000,000. The Federal government of Canada announced recently that the Dominion's known reserves of uranium ore were estimated at 225,000,000 tons. According to Eldorado Mining and Refining, the Crown-owned company responsible for Canada's uranium production programme, by December 31, 1957, output will be at the rate of 3,300 tons a year.

Although various types of asbestos are found in many countries, immense deposits of the high quality and very desirable chrysotile variety have led to the establishment of Canada as the leading world producer — a position which she seems to be in very little danger of losing. For many years Canadian production has accounted for 60-65 per cent of the world total.

Although production last year may have been lower by

Site of exploration shaft at Inco's nickel development project at Moak Lake, Northern Manitoba



Another year of mineral production records for Canadian mining is indicated by "The Northern Miner" in its Annual Review Number for 1956, on which this article is based. It is estimated that the value of last year's output will be close to \$1,700,000,000. If petroleum and natural gas are included the total value will exceed \$2,000,000,000. Last year it was \$1,800,000,000 and in 1954 a little less than \$1,500,000,000.

a few thousand tons than in 1955, when for the first time it exceeded 1,000,000 tons, it was anticipated that the dollar value of output would set up another new record by amounting to over \$100,000,000, the figure indicated being in the region of \$103,000,000.

Looking ahead, the Canadian asbestos industry forecasts that domestic production will rise to about 1,300,000 tons by 1960, an increase of some 30 per cent over present levels. Thereafter further increases will raise it to nearly 1,600,000 tons in 1965 and more than 1,900,000 tons by 1980.

Free world slab zinc production in 1955 amounted to a record 2,528,960 tons compared with 2,292,640 tons in 1954. About 1,030,400 tons came from the U.S., while Canada remained the second largest producer with 257,600 tons. For the first six months of 1956 U.S. mine production was 269,259 tons of zinc, but Canada's output at 215,640 tons was some 4,800 tons higher than over the the corresponding period of 1955.

The Dominion has two zinc smelters, both in western Canada. East of the Manitoba border all zinc is produced in the form of concentrates, which are shipped to the U.S. or Europe for treatment. Both Canadian plants use the electrolytic process.

The principal source of zinc in Canada is the Sullivan mine at Kimberley, B.C., owned and operated by the Consolidated Mining and Smelting Co. In 1955, this mine

produced 2,836,577 tons of lead/zinc ore. Cominco has four other producers of zinc concentrates in British Columbia and also treats custom ores and concentrates from mines chiefly in B.C. and the Yukon. Its 1955 output of refined zinc from all sources was reported as 190,910 tons or about 44.5 per cent of the country's total production.

The other Canadian producer of refined zinc is the Hudson Bay Mining and Smelting Co. at Flin Flon, Manitoba. In 1955, this company produced 67,356 tons of slab zinc from 1,642,943 tons of ore.

Canada is the world's largest exporter of aluminium and the second largest producer. Despite production cut backs in the early months of 1956, due to severe shortages of hydroelectric power, output of primary metal was expected to reach an all-time peak, owing to the introduction of new capacity. The 1955 output amounted to 588,000 tons.

Canada's sole producer of aluminium, the Aluminium Co. of Canada, is expanding capacity at a fantastic rate. In the last five years expenditure on new plant, most of it in the Dominion, has averaged \$2,000,000 per week; by 1957, the company will have poured close on \$1,000,000,000 into the programme.

Alcan currently has four smelters operating in Quebec with a fifth on the drawing boards. Arvida, Beauharnois, Isle Maligne and Shawinigan Falls have a total rated capacity of 582,000 tons annually. The newest project—a \$250,000,000 power and smelter development on the Upper Peribonca river — will boost aluminium-making capacity in the Saguenay area by 120,000 tons a year in three years. Capacity at Kitimat, now rated at 150,000 tons annually, is scheduled to reach 330,000 tons annually by 1959.

A second Canadian producer, Canadian British Aluminium Co., is well advanced in the construction of a \$130,000,000 plant at Baie Comeau, Quebec. Ultimate annual capacity of 160,000 tons should be reached in 1965, initial production of 40,000 tons being scheduled for 1957.

Canada is one of the free world's two largest sources of the platinum metals, the other being South Africa. Most of the Canadian output comes from nickel-copper ores of

the Sudbury district in Ontario. Increased demand for platinum indicates that production of this metal may have surpassed all records in 1956.

The largest Canadian supplier is Inco, with Falconbridge Nickel Mines the only other major source. Metal recovery for Inco takes place at Acton, England, and for Falconbridge at Kristiansand, Norway. Most of the refined metal is returned to Canada for re-export. There are a number of potential sources of platinum metals in Canada that are still in the exploration and development stage. At the moment the two most promising prospects are the Gordon Lake-Werner Lake property of Eastern Mining and Smelting Corporation in the Menora district of Ontario and the Wellgreen property of Hudson-Yukon Mining Co., a subsidiary of Hudson Bay Mining and Smelting.

Adult Status for Iron Ore

The fledgling iron ore branch of the Canadian mining industry, which started from scratch just before world war II, has already attained major status. It was anticipated that in 1956, by the time the last ore trains of the season pulled away from the Dominion's fast growing iron mines, 21,000,000 tons worth over \$168,000,000 would have been produced and shipped — 50 per cent more than in 1955 and more than triple the amount mined in 1954. In five or six years the annual production will have been hoisted to around 50,000,000 tons.

Approximately 12,000,000 tons of the 1954 output came from the New Quebec-Labrador field; 3,250,000 tons from Steep Rock Iron Mines, and 1,500,000 tons from Algoma Ore Properties in north-western and northern Ontario respectively; and 2,500,000 tons from Dominion Wabana Ore Ltd. in Newfoundland. The remainder came mainly from the operations of the Bethlehem Steel Co. near Marmora in southeastern Ontario and from British Columbia.

In line with the increased demand by the iron and steel industry for higher iron-content furnace feed, several properties containing low to medium grade iron ores amenable to beneficiation are receiving exploratory and development attention. One of these, the Hilton mine about 35 miles northwest of Hull, Quebec, is being prepared for production at a rate of 600,000 tons annually.

Iron ore deliveries from Canadian mines reached a record 19,100,000 tons in the first ten months of 1956, a gain of 35 per cent over the previous year's ten-month total of 14,100,000 tons.

Record Deliveries

Iron ore deliveries have set consistent records in recent years as the big Iron Ore Company of Canada's Ungava properties have started full production.

Most of the ore was exported, with shipments in the period under review up about 35 per cent to 17,400,000 tons as against 12,900,000 tons a year ago. Domestic deliveries also rose sharply, increasing 44 per cent to 1,700,000 tons from 1,200,000 in the corresponding 1955 period.

The Quebec-Labrador area accounted for most of the production, with Iron Ore or Canada expected to have shipped some 12,000,000 tons for the year. Deliveries from Ontario mines were 4,600,000 tons, up about 17 per cent, from 3,900,000 tons last year.

Steep Rock Iron Mines—largest producer in Ontario—exceeded its 3,250,000-ton shipping target in the 1956

navigation shipping season.

Lithium is a relative newcomer to Canadian mining. So far there is only one producer, Quebec Lithium Corporation. This company and several others have already indicated rich and extensive lithium deposits. In anticipation of an increasing demand, Quebec Lithium is expected to increase capacity from 1,000 tons to 1,500 tons per day by the middle of 1957. It has an indicated 1,000,000 tons averaging 1.5 per cent lithium oxide on its Irgon claims and an additional 800,000 tons averaging 2.13 per cent lithium oxide on its East Bernic claims, both in the Bernic Lake area of Manitoba.

Another potential producer in the same area is Montgomery Explorations with an indicated 7,887,218 tons averaging 1.85 per cent lithium oxide. Montgomery is now sinking a 3-compartment shaft. Other companies with large indicated reserves include Lithia Mines and Chemicals, Nama Creek Mines, and Canadian Scotia.

Canada is the world's largest producer of titanium slag (72 per cent TiO_2 plus desulphurized iron), which comes from the smelter of Quebec Iron and Titanium Corporation at Sorel, Quebec. Production at Sorel in 1955 was 162,784 tons containing about 117,042 tons of titanium dioxide. In the same year ilmenite shipments from Q.I.T.'s Allard Lake deposits totalled 444,235 tons.

Rapid progress is being made in the development of Canada's sulphur resources. No large deposits of elemental sulphur have yet been found in the Dominion, but there are abundant supplies of pyrite and other sulphide minerals, smelter gases, refinery gases, and natural gases high in sulphur content. Noranda Mines is building the largest sulphuric acid plant in Canada at Cutler, Ontario, to supply acid to the uranium mills of the Blind River area. Initial capacity began in July, 1956, and by June this year capacity is expected to be 1,000 tons daily. The plant is being started on imported sulphur, but early this year, when the sintering plant has been completed, the raw material will be by-product pyrite originating in Noranda's own mines at Noranda, Quebec.

Exceptions to the Prosperity Rule

There are only two notable exceptions to the expansion of Canada's mining industries. Coal, its prospects dimmed by the oil and gas that are steadily supplanting it as energy sources, continues a downward output trend, with no prospects of improvement in sight. Gold, buttressed by government assistance, is just about holding its own in the battle against rising costs. The value of last year's output is estimated at \$156,000,000 against \$157,000,000 in 1955. With no new mills being built and no prospecting in progress, the outlook is regarded as bleak.

It is noteworthy that every mining province is sharing in the continued growth of the Dominion's mining industry. New mines are being established, and many more are in prospect, from New Brunswick and Newfoundland to Vancouver Island and the Yukon; from Southern Ontario to the shores of Ungava Bay. Particularly encouraging is the progress which has been made in the far north, where widespread indications of many minerals have been known for many years.

The rapid expansion of Canadian mining is, of course, bringing its own problems, of which the most serious is that of manpower. The new uranium mines alone will require perhaps 10,000 or 15,000 men. To meet this situation the Canadian Metal Mining Association sent a mission to Europe in 1956 to survey the situation and conduct a recruiting campaign. In all, some 700 men were recruited overseas last year for mining employment, mainly from Great Britain and Ireland.

MINING MISCELLANY

The Marcona Mining Co., owners of extensive iron ore deposits in Southern Peru, are reported to have located other deposits at Puerto Caballa and Pampas de Coyungo in the Department of Ica.

A deposit of pitchblende is being investigated by the U.K. Atomic Energy Authority in Southern Rhodesia 10 miles south of Umtali. Officials in Salisbury stated that at this stage no estimate of the extent of the deposit could be made.

The Central Mining and Investment Corporation has secured a mineral concession over 200 square miles in the Tete area in Portuguese East Africa. Drilling has been started at Chidue, where indications of copper have been found.

Mining news from Indonesia is summarized in a recent report as follows:—The draft mining bill was considered by the Cabinet and it is shortly to be brought before Parliament. Manganese ore has been discovered near Djokjakarta. A prospector declared that he had discovered reserves of gold bearing rock in Menado that were "greater than those of Alaska." The Government has announced that all mining concessions must be worked forthwith or surrendered.

A merger is being arranged between two important firms in the compressed air industry. They are Holman Bros. Ltd., of Camborne, a private company founded in 1801, and Broom and Wade, Ltd., of High Wycombe, which has been a public company since 1935. Holman Bros. Ltd., also control the Climax Rock Drill and Engineering Works Ltd. The arrangement will strengthen the export business of the two companies, which already amounts to over 50 per cent of their joint output, and it will enable the Holman factories in South Africa and Australia to assist in maintaining the equipment of both companies overseas. Both firms emphasise that the degree of overlap in their range of products is small and that their products where similar are being sold in different markets.

A geological survey of the whole of Kerala State, in Southern India, is to be undertaken by the Indian Ministry for Natural Resources. The Ministry is considering an offer from geologists at Travancore-Cochin University to assist in a preliminary survey of the coastal strip for oil deposits. In addition, surveys will be carried out to assess the extent of gold, lignite and non-ferrous metal deposits in the area.

A 6 ft. core section drilled from hole C13 on the Hungary Hill mine at Allihies, West Cork, has shown values averaging 8.5 per cent copper, states the Emerald Isle Mining Co. Ltd., a subsidiary of Can Erin Mining Corporation of Toronto. Drilled from surface below the old Coom workings, 2,500 ft. south-east of the Mountain Mine, the hole cut 60 ft. of copper mineralization.

Additional to the high grade 6 ft. section, a 2 ft. section from 18 ft. further down averaged 4.7 per cent copper. Both core sections have been sent to Canada for assay, while the remainder of the 60 ft. mineralized core has gone to Britain. The results of the assays are expected shortly.

PERSONAL

Among the awards in the Queen's New Year's Honours List is a knighthood to Mr. Frederick John Pascoe, chairman and managing director of British Timken and other companies. Recipients of the O.B.E. include Mr. T. B. Bassett, senior district inspector of mines and quarries, S.W. Division, Ministry of Fuel and Power; and Mr. C. G. Simpson, deputy director general of staff, National Coal Board.

Mr. John Hay Whitney, the newly-appointed Ambassador from the United States to the Court of St. James, is chairman of the board of a company which has strong trade ties with the U.K. The company, Freeport Sulphur, is a major supplier of sulphur for the British chemical, fertilizer and other industries. It is the oldest American sulphur producer.

Mr. H. S. Malik, lately Indian Ambassador to France, has been appointed special director (India) of Simon-Carves, Ltd., a company which has important interests in India where it maintains a permanent staff. Mr. Malik will be resident in Delhi.

Mr. G. N. Bridge has been appointed a director of Associated British Oil Engines (Export), Brush Export, and National Oil Engines (Export), the export companies of the Brush Group. He retains his position as the group's London manager.

The following have been appointed by Thos. W. Ward Ltd., as local directors: Messrs. Ernest Springthorpe, Norman Bradshaw, Eric Wolstenholme, George Page, Reg. Hadfield and Alfred Kissack.

Mr. D. F. Wagstaff has been appointed chief engineer of Plowright Brothers Ltd., of Chesterfield. Mr. G. L. Doris has been appointed technical sales manager.

Mr. T. Dawson has been appointed to

the new post of Group Export Sales Manager for the Chloride Group. He will also be responsible for commercial liaison with the group's overseas associate companies. Mr. P. C. Aspinall, who was assistant export manager, becomes the new export manager for Chloride Batteries Ltd. in succession to Mr. Dawson.

Mr. Frank Rowe has been appointed a director of the George Cohen 600 Group Ltd. the holding company which controls the 600 Group.

Mr. Harold John Frederick Gourley, president of the Institution of Civil Engineers and one of Britain's foremost water engineers, died at Guy's Hospital on December 18.

The Mond Nickel Fellowships Committee has announced the award of two fellowships for 1956. The recipients are Mr. R. Bandy, of the English Steel Tool Corporation Ltd., and Dr. J. Hargreaves of the United Steel Companies Ltd.

The West London Office of the Export Credits Guarantee Department will take over new premises at Romney House, Marsham Street, London, S.W.1 (Telephone, Abbey 6271) on Monday, January 7, 1957. Since 1954, the value of current short term policies in the area covered by this office has risen from £47,000,000 to £126,000,000 annually. During the same period the value of medium term business in the area increased from £31,000,000 to £73,000,000.

AGENCIES WANTED

Mesbla S.A., an importing firm and department store in Rio de Janeiro, has inquired whether any U.K. firms are interested in exporting new types of mining machinery to Brazil. Manufacturers interested should write to Mesbla, S.A., Sec. Máquinas p Construcões, Britagem, Mineração, Agencia Sao Cristovao, Campo Sao Cristovao 290, Rio de Janeiro (Atencao: Eng. Sergio Ghirardello, Chefe de Secao). They are asked to notify the British Embassy, Commercial Department, Praia do Flamengo 284-20 Andar, Rio de Janeiro, that they have done so.

B.O.T. Ref.: E.S.B./30563/56. Telephone enquiries to Chancery 4411, Extension 776.

CONTRACTS AND TENDERS

The following future authorizations have been announced by the International Co-operation Administration (I.C.A.):

	Contract Period	Terminal Delivery Date	Amount (in U.S. dollars)
Pakistan			
Construction, mining and conveying equipment (PIO/C No. 91-81-001-6-21883)	29/11/56-31/12/56	30/6/57	19,125
Thailand			
Construction, mining and conveying equipment (PIO/C No. 93-31-066-9-70049)	15/11/56-30/11/58	30/11/58	80,000
B.O.T. Ref.: E.S.B./31533/56/I.C.A. Telephone enquiries to Chancery 4411, extension 360.			

Machinery and Equipment

Mine Rope Breaking Tests in South Africa

The multi-rope winding system is being subjected to a number of careful tests, not only to prove the efficiency of the equipment but also to check the safety devices for the cages. These tests include breaking a rope—or, at any rate, some of the strands in a rope—in the shaft while a cage is in motion. It is not nearly as easy to do this as it may seem, and considerable experiment was necessary to find the best way of breaking the rope. The experiments were described in *Optima*, Vol. 6, No. 4, a quarterly review published by the Anglo American Corporation of South Africa.

It was decided to use explosives rather than a mechanical method. A sinking bucket filled with scrap iron (weighing in all about four tons) was suspended about 2 ft. from the ground by a rope 1 in. in dia. and having a breaking strength of about 48 tons. Eight 60 per cent gelignite primers, 4 in. long by $\frac{1}{4}$ in. dia., were tied lengthwise around the circumference of the rope. The explosion merely removed the rope dressing.

In the next experiment the explosive charge was divided into two, one charge above the other on opposite sides of the rope. This method was more effective, and after a series of tests during which the amount of explosives used was gradually increased, the rope was broken successfully with 556 lb. of explosives.

An explosion of this order, however, would have been too great for use in the timbered shaft in which the main test was to take place, and it was necessary to find some means of breaking the rope with a smaller charge. It was realized that the initial force of the explosion was probably being expended in flattening the rope before starting to break it, and a type of shear plate was made to hold the cross-section of the rope rigid and to act as a guillotine against which the rope would be cut rather than broken when the explosion took place. This proved to be so effective that the rope could be broken with a total charge of 3.64 lb. of explosive. This explosion was still too big, however, and it was found that by using gelignite cartridges

of 2 in. dia., moulded to fit in close contact with the rope, the maximum effect of the explosion was obtained. The rope used for this experiment was the same type as that to be used in the actual winding test—namely, $\frac{7}{8}$ in. in dia., having a breaking strength of 27 tons. The rope was broken with 0.48 lb. of explosives, which, incidentally, was exactly half the amount of explosives needed to break the rope without a shear plate.

It has now been found that, for the purposes of the full-scale experiment in the shaft, only two of the six strands in the rope will need to be broken. Thus it is probable that the weight of explosives can be reduced considerably below the $\frac{1}{2}$ lb. used in the last test.

A WATER-CONTROLLED PICK

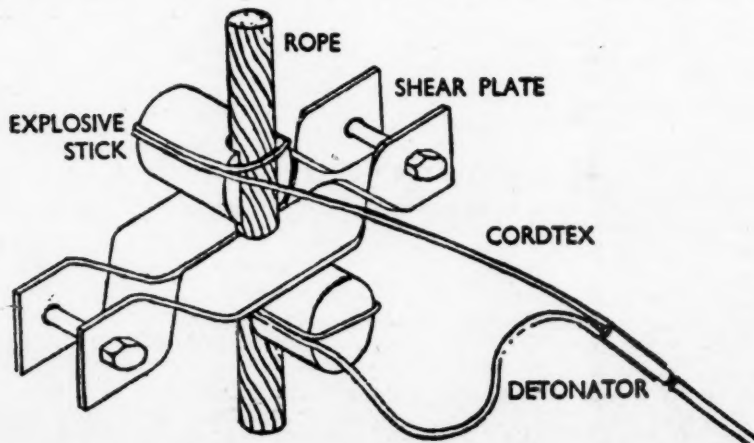
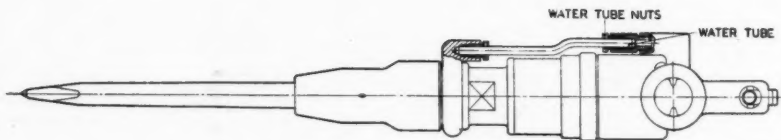
Approximately 300 Climax S.W. 2B water-controlled picks currently are in use in the South Western Division of the N.C.B., 40 are on trial in other Divisions, and 20 are in use in France. The S.W. 2B pick was developed finally in February, 1956, and is the subject of a recent Information Bulletin (56/175) from the N.C.B.

The pick is so designed that the air valve is operated by water pressure. When the trigger is depressed, water under pressure is passed from the handle to the spray ring at the front of the cylinder by way of an external stainless steel water tube. Simultaneously, water passes to the top of a rubber diaphragm which deflects under pressure, opens the air valve, and enables air to pass and operate the pick. It is therefore impossible to

use the pick unless water at adequate pressure is connected.

The split spray ring is attached to the cylinder by a through-bolt and contains three equally spaced spray nozzles which provide complete coverage of spray around the pick point. The area wetted at 50 lb. p.s.i. is not less than 16 in. dia. at 15 in. distance from the retainer. Clogging is effectively guarded against

Above is shown a cross section through the Climax S.W. 2B water-controlled pick, while below is a diagram showing the operation of the explosive test system used on mine ropes in South Africa



and effective wetting is ensured when the pick is driven right into the coal.

Without steel pick attachment the machine is 18½ in. long and weighs 23½ lb. Bore is 1½ in. and stroke 2½ in. Air consumption at 80 lb. p.s.i. is 32 cu. ft. per min., while 2,563 blows are struck per minute. The pick takes N.C.B. standard "hump" shank to drawing 7,500/3. Water consumption at 50 lb. p.s.i. water pressure is $\frac{1}{2}$ or $\frac{1}{4}$ or 1 gal. per min.

In a recent test between dry and water-controlled picks, the mean additional concentration produced by the dry picks working on a water-infused face was 439 p.p. cc., while that for the water-controlled wet picks was 274 p.p. cc., i.e. a difference of 38 per cent.

A NEW COAL PREPARATION PLANT

Two qualities of coal, a high and low sulphur content, are being mined at Cwm Colliery, South Wales, and as the output will primarily be used for the manufacture of metallurgical coke it is imperative that the two qualities be kept separate so that an acceptable blend of the two coals, after cleaning, can be obtained for the coke works.

For this reason the coal preparation plant at Cwm Colliery has been made in two separate but identical sections each having a capacity of 200 tons per hour. The two types of coal are conveyed from the pit at a maximum rate of 500 tons per hour and discharged into a 400 ton capacity bunker, the bunker having two compartments to receive the alternative qualities of coal. From the bunker, conveyors carry the coal to the two plants.

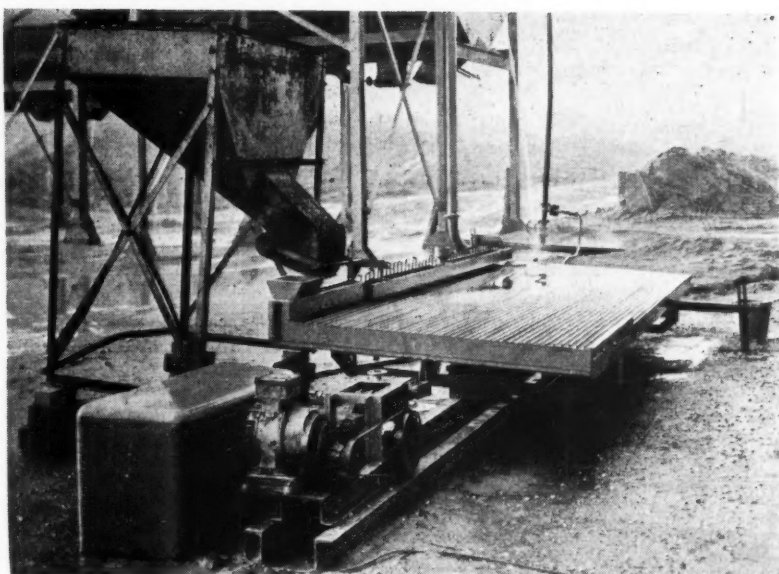
The whole of the raw coal output from Cwm Colliery will be cleaned mechani-

cally by two processes only; the Chance sand flotation process for coal down to $\frac{1}{16}$ in. in size and the Fraser and Chalmers Mineral Separation froth flotation process for the remaining $-\frac{1}{16}$ in. fraction.

Upon entering the plant the run-of-mine coal passes over a screen which separates the coal larger than 8 in. from that smaller than 8 in. The larger coal is then broken down to -8 in. by a pick breaker after which it joins the natural -8 in. material. A second screen grades the coal at $\frac{1}{2}$ in., water sprays being used to increase the efficiency of this screening. The 8 in. \times $\frac{1}{2}$ in. raw coal is then fed by conveyor direct into the Chance cone. Meanwhile, the $-\frac{1}{2}$ in. coal, together with the water, passes to a battery of four Sherwen vibrating screens where the $-\frac{1}{16}$ in. fraction is removed. The $\frac{1}{2}$ in. to $\frac{1}{16}$ in. coal from these latter screens joins the feed to the Chance cone and at the same time the $\frac{1}{16}$ in. -0 coal is laundered to a sump before being delivered to the froth flotation plant.

The Chance cones of the two identical plants at Cwm Colliery are arranged at present to give a clean coal and refuse product only, but facilities have been provided so that middlings, i.e. a second-grade coal, can be produced, if required,

Above, the new Wilfley ore concentrating table is shown assembled on site with the protecting cover removed. Below is the new 400-tons per hour coal preparation plant at Cwm Colliery, South Wales



bubbles rise to the surface of the water and overflow into a launder. From the launder the pulp of clean coal and water passes to rotary vacuum filters for de-watering. The cake or de-watered product from the filters is blended with the $\frac{1}{2}$ in. $-\frac{1}{16}$ in. fraction of the clean coal from the Chance cone, and the blend is conveyed to a bunker for ultimate loading into wagons or direct to the coke ovens. When under full operation the Cwm plant will produce in the region of 5,000 tons a day of good quality coking coal.

A NEW DESIGN OF CONCENTRATING TABLE

The Wilfley Mining Machinery Co. have now installed their latest design of ore concentrating table on site. This new machine has been built with a special eye to the export market, where every effort must be made to reduce size and weight owing to the high cost of pack-

ing and freight charges.

The new Wilfley head motion consists of a modified reciprocating motion within a light framework of mild steel welded angle. Besides being lighter than the present model, it is in addition driven by a small motor. The whole unit is contained in a weatherproof housing.

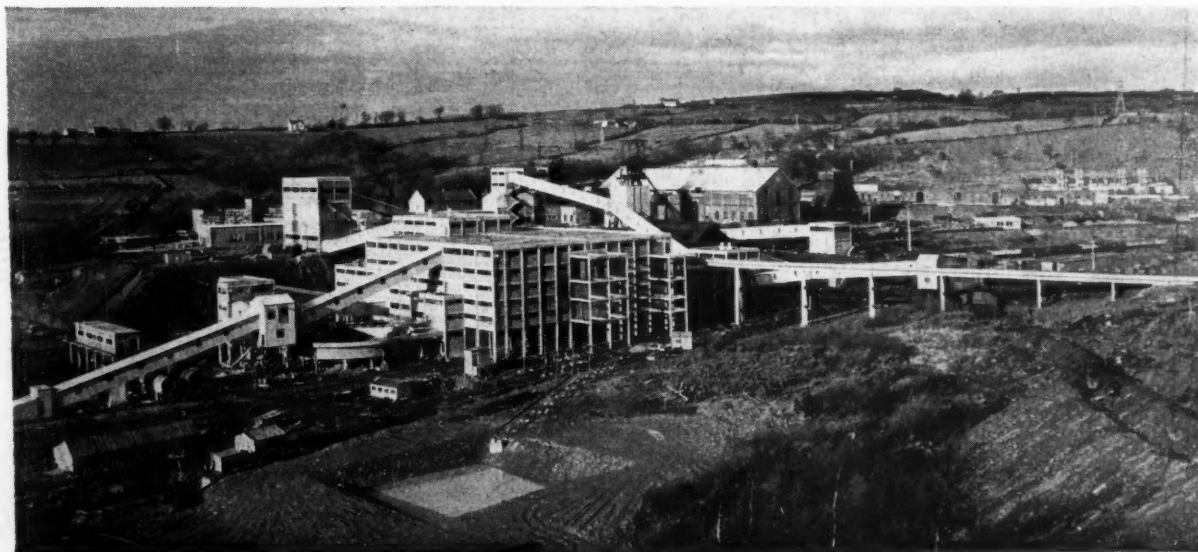
The table deck and supporting structure has also been re-designed, the slipper housings and tilting gear being dispensed with. The deck is now supported on laminated springs. A salient feature of the new deck is that it can easily be taken apart for export packing.

Tests so far carried out on site have been favourable. The site chosen for testing is open to the full force of the weather to fully ascertain the durability of the machine before it is put on the market. It will be some months before experiments are completed, and it is doubtful whether any of these machines will be ready for export until the latter half of the year.

in future by the installation of additional equipment.

The $-\frac{1}{16}$ in. fine coal which collects in the sump or slurry basin is pumped to the banks of froth flotation cells via head boxes. Two banks of cells have been allocated for each of the two separate plants, the capacity of each single bank of cells being 20 tons per hour. The purpose of the head boxes is to control the amount of coal and water entering the cells. The frothing oil is introduced into the cells together with the coal and water, and high-speed agitators entrain air to create the froth bubbles.

The clean coal particles adhering to the



Metals and Minerals

Metals In The Crystal Ball

This is the season when metal producers and government experts alike are wont to gaze into their crystal balls in attempts to foresee the supply-demand picture for the coming twelve months. With the proviso that no authority, be he ever so knowledgeable, can make allowance for all the unpredictables, political and otherwise, which can influence the metal markets, we offer a few gleanings from contemporary prophets. Nearly all of them emanate from the U.S., which, of course, is by far the largest purchaser and consumer of free world metals and minerals. Doubtless British authorities on metals are no less addicted to crystal gazing than their opposite numbers across the Atlantic, but they are decidedly more reluctant to let their prophecies see the light of print.

First in our list of seers is the U.S. Secretary of Commerce, Mr. Sinclair Weeks, who forecasts that in the first half of 1957 sales and production should equal or exceed the record performance of early 1956. Achievement of this high-level of output will depend on avoiding any "international emergency" and, in some cases, on the ability of builders and manufacturers to get scarce materials.

Demand for copper is expected to be quite strong in the next few months, but will then tend to taper off. Trade sources consider that copper producers will fight much more vigorously to hold the 36 c. price level than they did at the 40 or 46 c. lines. A factor which might assist them is that much of the expansion of copper productive capacity in the past five years was done with government "floor price" contracts, some of which will offer alternative markets should prices drop much further. It is generally held, therefore, that even if copper cannot be held at 36 c. indefinitely with the brass mill industry operating at only 65 per cent capacity, the price is not likely to fall below 30 c. unless a protracted recession occurs. Mr. C. J. Gross, of American Smelting and Refining, has expressed the view that, barring unforeseen developments of a political character, the indications are for "continuing stability in the copper structure".

Two weeks ago we published some encouraging observations by Mr. Holbrook A. Davis, a sales official of Alcan, on aluminium's prospects. Similar views have since been put forward by the president of Reynolds Metals, Mr. Richard S. Reynolds, Jr., who forecast that in 1957, for the sixth year in succession, his industry would break the previous annual record for production of primary metal. Mr. Reynolds also predicted that requirements for aluminium would set new consumption records as a result not only of expanded demand for existing uses but by reason of constant development of new ways of utilization. On the basis of the current outlook for 1957 there should be a healthy balance between supply and demand. With the industry apparently free from shortages, the market growth of recent years should continue unabated.

U.S. titanium producers have doubled and redoubled production in the past six

years at a pace unparalleled in the metals industry. Mr. T. W. Lippert, manager of sales and technical service, Titanium Metals Corporation of America, observes that the firm goals set for 1957 represent the spectacular challenge of a 135 per cent increase. As production mounts and know-how increases, conventional production methods are performing better and better, both cost-wise and quality-wise. The industry continues, however, to search for a revolutionary new extractive procedure having possibilities of very low costs. Electrolytic winning still shows the greatest promise and industry observers look for solid achievements in this field during the next five years.

Mr. Harold A. Berry, discussing the importance of Inco's development in Manitoba in the latest Bulletin of the National Association of Purchasing Agents, states that, even if no nickel is stockpiled during the whole of 1957, this metal will remain in short supply for a long time to come. Increased purchases for defence projects will soak up much of the material that will be diverted from the U.S. stockpile.

"The demand for nickel is a fooler", writes Mr. Berry. "The metal has been scarce for so long that potential users think of it in terms of reduced application. They dare not think of it in terms of new and novel uses. If nickel were in free supply, plates alone would double their usage, steel mill purchases would soar, and new uses would quickly be developed." The published price of 74 c.—which should hold—is described as a bargain for those fortunate enough to buy at that figure.

Despite the steel strike, U.S. production and consumption of ferro-alloys for 1956 were about equal to those of 1955, the all-time record year. Based on projected requirements, Mr. A. L. Foscoe, president Electro Metallurgical Co. (ferro-alloys and metals division of Union Carbide and Carbon Corporation) foresees still higher sales in 1957.

Notwithstanding the severe dip in sales of motor cars, output of stainless steel in 1956 was at levels approximating the 1955 record, due to increased usage in other industries. In 1956, production of the chrome-nickel-manganese stainless steels, known as the 200 series, rose to an estimated 20,000 ingot tons from slightly under 2,000 tons in 1955. Output of these nickel-conserving stainless steels should soar again in 1957 and the 1960 production goal of 150,000 ingot tons now seems conservative.

The U.S. steel industry enters 1957 with confidence, reports Harleston R. Wood, president, Alan Wood Steel Co. Capacity operations seem assured at least through the first six months and it is generally believed that a high operating rate will continue for the whole of the year. All predictions indicate that demand for every basic steel product will increase very substantially in future years with growing population and a rising standard of living. This, of course, ensures an expanding demand for iron ore, of which Canada alone expects to be

producing some 50,000,000 tons annually in the next five or six years.

On the technical side Mr. D. S. Harder, executive vice-president, basic manufacturing divisions, Ford Motor Co., foresees new techniques in the extraction, melting and refining of iron ore, which will allow the steel mills of the future to be located "right next door" to the iron mines, the ore being converted to steel in a single continuous operation. New and improved plating processes will allow elaborate alloys to be deposited on the cheapest of base metals. Future developments in materials might also include the alloying of aluminium, titanium and magnesium with unique materials like columbium, in such a way that their engineering properties are vastly improved.

U.S. motor car manufacturers produced about 2,130,000 cars in 1956—a decline of 26.8 per cent from the record output of 1955. According to *The Wall Street Journal*, this year's production will be second only to that of 1955. The upward trend will be reflected by rising consumption of a number of metals—notably lead, tin, zinc, copper, aluminium and the stainless steel metals.

The omens are good—they might even be described as dynamic. It will be instructive—but not, let us trust, chastening—to look backwards at the end of 1957 and consider to what extent the heartening views of the crystal gazers have been borne out by events.

INDIAN MANGANESE TRADE

Judging by recent reports the manganese picture in India still appears to be confused. It has been stated in some quarters that the higher grade ores have not been leaving the country in quantities commensurate with mine production. This situation, assuming that it does in fact exist, has been attributed to various factors, among the explanations put forward being inadequate internal transportation and refusal by the government to provide licences to move the ore in India. Whatever the position in regard to shipments, it seems evident that recent activities of the Indian government have discouraged miners, disrupted the established channels of trade, and sapped the confidence of consumers in the U.S. and other markets.

The activities of the State Trading Corporation have not decreased. A few weeks ago the S.T.C. called a meeting at which it was expected to purchase some 30,000 tons or more of ore. The Corporation is alleged to be looking for ways to get a larger return from the Indian manganese trade than can be anticipated from the export duty. It was recently reported to be charging a commission of 6½ per cent to help some firms meet their quotas. Though it was not intended that this should be passed on to the consumer, the opinion has been expressed by some factors that this is likely to occur. There has also been talk of a pending commission of 1½ per cent on exports of less than

38 per cent grade ore, on which no export duty is payable. Meanwhile, the prices of Indian manganese ore remain very firm.

SELENIUM PRICE CUT

From January 1 the American Smelting and Refining Co. has reduced prices for the grades of selenium it produces by between \$3 and \$3.50 per lb. and is resuming production of commercial grade selenium. These developments are indicative of an improving supply position, which has lately been reflected in the U.K. by reports of transactions in non-Canadian selenium at less than the Canadian price of 112s. per lb, which has been lowered to 85s. 9d. from January 1.

SOVIET NON-FERROUS PROBLEMS

The Soviet Industrial and Economic Gazette has published some interesting details of trends in Russian non-ferrous metal production. *Inter alia*, the publication says production of gallium on a commercial scale has started recently, while equipment for the production of vanadium pentoxide as a by-product of bauxite processing is being installed at an aluminium plant.

However, while some progress has been made in this direction, there is alleged to be a great deal of wastage in other respects. For instance, the copper ores mined in the Urals contain zinc, sulphur and many rare metals, but nothing is done to extract these substances from the Ural copper ores and concentrates. Furthermore, much metal is wasted at nickel, lead and zinc smelters by the failure to make any use of the flue dusts from smelter gases, which are thrown away. In addition, several million tons of slags have accumulated at non-ferrous metal smelters. The publication states that, although it has been found that these residues have a zinc content of 2 per cent and a lead content of 10 per cent, no use is made of these potential raw materials.

The journal adds that this "careless attitude" also extends to the search for ore. In probing for ore the prospectors of the Ministry of Non-Ferrous Metal Production have neglected the rare metals and have concentrated on copper, zinc, tin, lead and nickel. Although a special directive had been issued in 1954 emphasizing the need to seek these rare metals, very little has been done so far.

FLUORSPAR IN THE U.S.

The fluorspar reserves of the U.S. have been found to be considerably greater than had previously been estimated. They are now placed at around 22,500,000 tons of ore containing 35 per cent or better calcium fluoride. About 61 per cent of this reserve is measured and indicated ore and the remainder inferred ore. This latest estimate is about 5,000,000 tons higher than the figure arrived at some two years ago.

The U.S. consumption of fluorspar has been steadily increasing in recent years. In the first half of 1956 it reached 323,617 s.tons, which compared with 566,636 tons in all 1955. Domestic production has also been rising and amounted last year to 291,275 tons. In April-June, 1956, a record quarterly output of 81,812 tons was achieved. The gap in supplies is bridged by imports, which totalled 363,421 tons in 1955 and

219,611 tons in the first six months of 1956. The chief sources of imported fluorspar, in order of tonnage, are Mexico, Spain, Italy, Canada and Germany. Substantial tonnages of acid grade were acquired by the U.S. Government last year through barter deals and also through a domestic expansion contract and its purchase programme for metallurgical grade. Public Law 733 provides that the Government shall purchase a total of 250,000 tons of newly-mined acid-grade fluorspar during the coming 18 months.

For some time the Government has been under pressure by domestic producers to determine whether fluorspar imports constituted a threat to national security.

COBALT RADIATION SOURCES

Cobalt is becoming increasingly important as a radiation source. The first British-made, full-scale, cobalt unit has been installed at the London Clinic for use in medical therapy. It has a protective head containing 350 curies of radioactive cobalt in the shape of a sphere about 2 ft. in diameter and weighing 2 tons. It is protected sufficiently to take a maximum of 2,000 curies of cobalt. The unit was manufactured by Nuclear Engineering, of Greenwich.

The most powerful radiation unit in the U.S. has been installed at Chicago by Admiral Corporation. The source is an integral part of a specially designed nucleonics laboratory, which was

opened to study radiation damage to electronic components. Rated at 20,000 curies, it dwarfs the installations in use at medical research centres for the treatment of cancer. It is more powerful than the source at the Air Force Base in Dayton, hitherto rated the largest in the U.S., which is used for making radiation tests on aircraft materials.

TURKISH WOLFRAM PLAN

Agreement is reported to have been reached between the Turkish Etibank and Krupp of West Germany for setting up a joint West German Turkish concern to exploit the wolfram deposits of the Ulu-Dag area near Broussa. Krupp's participation would take the form of supplies of plant and equipment for the mines. These deposits, which have been referred to in this column from time to time, are said to be very large, but at this early stage it is impossible to assess the potential impact on the tungsten market of the addition to world supplies.

NEW NICKEL MILL

Preliminary construction has started on a new \$12,500,000 concentrating plant for Inco on a site adjacent to the company's Levack Mine, five miles west of Sudbury, Ontario. The new mill is scheduled to go into operation in 1958 and will have a rated capacity of 6,000 tons daily. It will produce both nickel sulphide and copper sulphide concentrates.

COPPER • TIN • LEAD • ZINC

COPPER IN THE DOLDRUMS

World copper markets have remained quiet over the past week because of the consequence of Christmas and the effect of end-year considerations; on January 1, of course, markets were closed. In the United States the big producers are still holding their price of 36 c. per lb. with the majority of the customs smelters following their lead. International Mineral and Metal Company, having already quoted 35½ c., later reduced its price to 35 c. per lb. but this lead was not followed by any other of the customs smelters, who appear to have little excess metal available for January and no one is yet prepared to quote a firm price for February delivery. Meanwhile, Number 2 scrap copper, after firming in the last week of the old year, has since slipped back again to 28½ c. per lb. The export quotation is somewhere around 34½ c. but business is not brisk, most interest has come from Japan but even this has waned seasonally.

There is no reason to suppose this outlook can alter very much in the coming weeks. The opinion of brass mills is particularly gloomy. Since there is plenty of copper available, and the customers know it, their buying from the brass mills is strictly hand to mouth. There is no danger in this policy since the brass mills are capable of delivering in a matter of days, and moreover, if the copper price moves at all, it seems certain to move downward. The brass mills are currently operating at between 65 and 70 per cent capacity and it is difficult to see how this rate of output can be raised, or how the

brass mills can break out of the circle formed by the facts of ample supplies and close buying.

The only sign of life on the American scene is the pressure from fabricators to secure a lower copper price on the grounds that their foreign competitors are obtaining the metal much cheaper than themselves.

There is, of course, a moral force in this argument, but the copper producers realize only too well that a cut in price in present circumstances would almost certainly not increase sales. However, if the London price went significantly lower in the coming weeks, pressure from the fabricators' customers might become very difficult to resist. The *Wall Street Journal* quotes the case of safety-pin manufacturers in the United States who cannot compete with British imports of safety-pins and appears to attribute this failure to the varying prices paid for copper. It adds that American manufacturers of these pins are seeking a higher tariff or import quotas. This is a fair example of the natural consequences of a fixed price policy which ignores market realities.

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The Copper and Brass Research Association estimated that for 1957, total world copper capacity excluding the Soviet sector, would be 3,505,000 tons—1,190,000 tons from U.S. and 2,315,000 tons from foreign mines. This would compare with the 1956 estimated world production of 3,313,000 tons—1,130,000 tons U.S. and 2,183,000 tons foreign output.

From Northern Rhodesia it is reported that the strikers at Bancroft have now returned to work although it does not appear that this dispute has yet been settled. Milling officially commenced at this mine on January 1. Scheduled production this year is 42,800 tons of copper, and the rate of output is to be doubled by early 1960.

TIN PRICE PAST ITS PEAK ?

Tin has been gently sagging in the past week or so and New York spot Straits metal is now down to \$1 per lb. With one exception influences on the market are now all somewhat bearish.

The details of the sale of the Texas smelter have still not been released but there is no reason to suppose that any hitch has arisen. In the circumstances it is only fair to assume that Texas will close down as planned at the end of this month. Certainly the market operators have taken this view for some time and have discounted the consequences of more concentrates coming on to the market. Possibly they have discounted too much since the concentrates will not become immediately available and there are long sea hauls for the Bolivian, Indonesian and Siamese tin.

The Middle Eastern situation has not worsened and the clearance of the Canal has at last got under way. President Eisenhower's vague proposals for guaranteeing peace in the Middle East may also be regarded as bearish, providing they do not provoke any violent reaction from Russia. Nevertheless when the Suez element has been written off the tin price, it will be found that there is a comfortably strong demand for the metal on both sides of the Atlantic.

The one bullish factor—and its strength at the moment is still incapable of assess-

ment—is the political crisis in Indonesia. Army officers in Sumatra have repudiated the authority of the government of Dr. Sastroamidjojo, which they have described as bureaucratic, inefficient and corrupt. At the present time all but a very small part of Sumatra is under army control.

Malayan output of tin concentrates, converted at 75.4 per cent was 5,008 tons in November, 1956. The estimated output for the whole of 1956 was 62,000 tons. The output in 1955 was 61,245 tons.

LEAD AND ZINC REMAIN FIRM

Lead has naturally been quiet over the Christmas season but the demand for the metal continues to be steady and with the present volume of stockpile buying adequate support is being lent to the market at the current price of 16 c. per lb., New York.

Demand for zinc has continued to be moderately steady with a fair volume of business for Prime Western grade at 13½ c. per lb., East St. Louis but without any great interest in special categories.

Consolidated Mining and Smelting Company is to spend \$1,630,000 on its zinc department at Trail, B.C. Canada. The programme calls for two 150-ton melting furnaces equipped with semi-automatic consumers for parcelling high-purity zinc into slabs. The plant is believed to be the world's largest producer.

The 'Frisco mine, the second oldest operation in the Coeur d'Alene area, is to be closed down by American Smelting and Refining.

The London Metal Market

(From Our L.M.E. Correspondent)

There have been no outstanding happenings on the Exchange since the last report, nor have there been any developments with regard to the U.K. government's release of lead and zinc, and the majority of talk has been about future developments in prices.

Consumption of copper may be lessened by lack of oil in Europe, and with production increasing at a steady rate it is felt that copper quotations will continue to decline: the majority of dealers feel, however, that the U.S. primary producers will endeavour to maintain a 35 c. lb. level, in which case prices in London should not go very much below £250 per ton. It is believed that with continued Japanese buying the custom smelters in the U.S. will not be forced to sell their copper at very much of a discount below the primary producers' price, whilst in Europe the lessening in supplies of scrap metal will also be a steadying factor.

The future of tin is obscure, and for the next three months most people appear to expect a market fluctuating between £740 and £780 per ton for forward metal.

The lead and zinc markets are completely dominated by the stockpiling policy in the United States, and as it appears that ways and means will be found to continue government purchases no alteration in the present American prices of 16 c. and 13½ c. per lb. respectively is expected, and this stability will in turn keep the London prices about their present levels, even if industrial demand does decrease slightly. Unfortunately, the backwardation on both metals are also likely to be maintained.

On Thursday morning the Eastern price for tin was equivalent to £779½ per ton c.i.f. Europe.

LONDON METAL AND ORE PRICES, JANUARY 3, 1957

THE WEEK ON THE L.M.E.*

	December 20		January 3	
	Buyers	Sellers	Buyers	Sellers
COPPER				
Cash	£271	£271½	£267½	£268
Three months ..	£270½	£271	£266½	£267
Settlement ..	£271½		£268	
Week's turnover	5,175 tons		7,300 tons	
LEAD				
Current ½ month	£117	£117½	£118½	£118½
Three months ..	£115½	£115½	£115½	£116
Week's turnover	3,125 tons		3,950 tons	
TIN				
Cash	£795	£796	£779	£780
Three months ..	£780	£782½	£768	£769
Settlement ..	£796		£780	
Week's turnover	745 tons		1,045 tons	
ZINC				
Current ½ month	£103½	£103½	£101½	£101½
Three months ..	£97½	£98	£97	£97½
Week's turnover	4,150 tons		4,775 tons	

* Prices for 7 days

METAL PRICES

Aluminium, 99.5%, £197 per ton

Antimony—

English (99%) delivered, 10 cwt. and over £210 per ton
Crude (70%) £200 per ton
Ore (60%) bases 23s. 6d./24s. 6d. nom. per unit, c.i.f.

Arsenic, £400 per ton

Bismuth (min. 1 ton lots) 16s. lb. nom.

Cadmium 12s. 0d. lb.

Carbon (99% net), £13 18s. lb. delivered U.K.

Chromium, 6s. 11d. lb.

Cobalt, 19s. lb.

ORES AND OXIDES

Bismuth	65% 8s. 6d. lb. c.i.f.
20% 3s. 3d. lb. c.i.f.	
Chrome Ore—	
Rhodesian Metallurgical (semifabrilite) 48%	£17 8s. 0d. per ton c.i.f.
Hard Lump (45%)	£17 8s. 0d. per ton c.i.f.
Refractory 40%	£12 15s. 0d. per ton c.i.f.
Smalls 42%	£15 9s. 0d. per ton c.i.f.
Baluchistan	£18 15s. 0d. per ton c.i.f.
Columbite, 65% combined oxides, high grade	190s./205s. per unit
Fluorspar—	
Acid Grade, Flotated Material	£22 per ton ex. works
Metallurgical (75/80% Ca F ₂)	151s. 6d. ex. works
Lithium Ore—	
Petalite min. 34% Li ₂ O	£8-£10 per ton f.o.b. Beira
Lepidolite min. 34% Li ₂ O	£8-£10 per ton f.o.b. Beira
Amblygonite basis 7% Li ₂ O	£35-£40 per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£22 0s. d/d
Molybdenite (85% basis)	8s. 5d. nom. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO ₂	£85 per ton c.i.f. Aust'n
Ilmenite 52/54% TiO ₂	£11 per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	220s./225s. per unit c.i.f.
Manganese Ore Indian	
Europe (46%-48%) basis 155s. freight plus 15% surcharge	140d.-150d. nom. per unit c.i.f.
Manganese Ore (43%-45%)	115d. nom. per unit c.i.f.
Manganese Ore (38%-40%)	110d. nom. per unit.
(including duty)	
Vanadium—	
Fused oxide 90-95% V ₂ O ₅	£12½-£13½ per unit c.i.f.
Zircon Sand (Australian) (65-66% ZrO ₂)	£20 per ton c.i.f.

Germanium, 99.99%, Gs.kilo lots 3s. 4d. per gram

Gold, 255½s.

Iridium, £29/31 oz.

Lanthanum (98/99%) 15s. per gram

Manganese Metal (96%-98%) £310

Magnesium, 2s. 5½d. lb

Nickel, 99.5% (home trade) £600 per

Osmium, £24/27 oz. nom.

Osmiridium, nom.

Palladium, £8 0s./£8 10s. oz.

Platinum U.K. and Empire Refined £34/£35 oz.

Imported £37 nom.

Quicksilver, £84 10s./£85 ex-warehouse

Rhodium, £42. oz.

Ruthenium, £15/£17 oz.

Selenium, 85s. 9d. nom. per lb.

Silver, 80d. f.o.z. spot and 79½ f'd

Tellurium, 15s./16s. lb.

Mining Finance**O.F.S. Goldfield now Established**

Any illusions that the Orange Free State was just a crazy mixed-up goldfield were definitely shattered yesterday when the remaining five O.F.S. gold/uranium producers in the Anglo American Corporation group released their annual reports covering operations for the year ended September 30, 1956.

These reports, together with that from Western Holdings, released at the end of last week, provide conclusive evidence that the O.F.S. is now firmly established as a separate and viable entity with a character all of its own.

Marketwise, the survey of operations at the different mines by Mr. Harry F. Oppenheimer should do much to inject confidence into the gold share market the behaviour of which, for some time now, has brought home to the investor in more ways than one that mines are wasting assets. Generally speaking, the reports are dynamic rather than dynamite but there can be no doubt that the spectacular has been sacrificed for the very-good—indeed results achieved consistent with sound mining practice.

Free State Geduld

The foregoing statement applies with considerable force to Free State Geduld where work is being directed towards achieving a better balance in mining operations as between the No. 1 and No. 2 shafts. This is being accomplished by pushing ahead as rapidly as possible with the opening up of the No. 2 shaft area to the south of the "water-bearing zone" (also known as the "major east-west fault zone" or "jack-pot area") and the area to the south and south-east of the No. 1 shaft. Values in the No. 2 shaft area are materially higher than those exposed at No. 1 shaft so that when the hoisting load can be more evenly divided as between the two shafts greater tonnages of higher reef values can be drawn from the No. 2 shaft area which will result in an improvement in the present milling grade. Some time this year it is intended to drive additional haulages to penetrate the rich water-bearing zone but work is being held up at the present time as development has advanced too far from the No. 2 shaft to provide adequate ventilation.

President Brand

The central point of the President Brand report is similar to that of Free State Geduld in as much as a better balancing of the work-load between the No. 1 and No. 2 shafts is essential before underground development can be resumed in the richer areas around the No. 1 shaft. Meanwhile, as development expands into other sections of the mine average values may fall away, but this will be more than compensated for by an increased crushing rate and improved mining efficiencies which will ensure a steady and continued rise in profits.

President Steyn

The Steyn report suggests that this mine—technically at any rate—is in the strongest position of any of the O.F.S.

mines in the Anglo-American Corporation group. Ore reserves are over the 3,000,000 ton mark, thereby enabling the scale of development operations to be slightly reduced which in turn will provide the necessary labour force to push ahead with stoping operations. This has become a matter of some urgency, as the reduction plant is now in a position to mill at 125,000 tons per month which compares with 94,000 tons in September last. While no improvement is looked for in the milling grade this year, an expansion in the tonnage throughput and an increase in working efficiencies will ensure a steady advance in profits. Revenue from uranium last year represented approximately 7s. 4d. per ton milled after interest and redemption payments. A further rise in earnings from this source can be confidently anticipated this year as the company's uranium plant will be able to operate at its full extended capacity of 150,000 tons a month in the second half of this year.

Western Holdings

It is difficult to fault the progress achieved by Western Holdings last year. It is true that uranium values so far disclosed do not indicate profitable treatment of the slimes but in every other aspect operations are going ahead smoothly. The crushing rate last year improved by over 16,000 tons per month and a further increase of 12,000 tons to something approaching 100,000 tons per month is looked for by the end of this year. Development work is described as having made excellent progress and the ore reserve position both in tonnage and in value is extremely satisfactory. More than that, higher values have been obtained from sampling since the end of the financial year and thus an interesting December quarterly report, due in the next fortnight, is anticipated.

Loraine

With regard to Loraine there is little encouragement to be found in the ultra-cautious statement describing its position and prospects accompanying the report. Indeed, the situation is well summed up by Mr. Oppenheimer, who states that: "The future of the mine depends on improvement in the present grade of ore mined. By increasing the proportion of stope tonnage from the "B" reef horizon, it may be possible to attain a higher grade, but as I have already indicated, it is too early to predict whether overall good values can be sustained, owing to the highly erratic nature of the gold occurrence in this reef. Uranium values of an economic grade have unfortunately thus far not been associated with the "B" reef.

"While every effort is being made to increase the milling rate as rapidly as possible, to prospect those areas where reef values appear to give most promise, and to maintain the high level of efficiency and economy which has been achieved on the mine, it is not possible at this stage to forecast the future profitability of mining operations on this property"

Welkom

Last, but certainly not least, is the report dealing with Welkom. In many ways, this is the most encouraging of all the reports and clearly reveals that after its long and frustrating struggle the mine has definitely turned the corner and is now on the road to fulfilling the high promise originally expected of it. Operating results have shown a greater overall improvement than in any previous year. Development values are at a peak level for the mine and ore reserves are now the largest of any of the Anglo American Corporation's O.F.S. properties. Furthermore, the value of the reserves at 6.3 dwt. gives ample scope for the milling grade to improve on its present yield of 4.4 dwt. per ton. Excellent progress has also been made with the sinking of the company's No. 3 shaft jointly shared with President Brand and President Steyn for ventilation purposes. When the new shafts are completed tonnages in excess of 100,000 tons per month will be possible. Even more important is the fact that the new shaft system will enable the South Western triangle of the company's lease area to be exploited. The reef in this area, which is inaccessible from existing workings, is expected to be of higher value than the average so far exposed in the mine.

The biggest surprise from Welkom was the announcement that uranium values are now such as to warrant treatment, and profits from this source are expected to be derived during the second half of this year. Looking further ahead to the first half of 1958 the company proposes to institute a system of surface waste sorting which should bring about a useful reduction in the milling widths, and a higher potential of profits which can be earned from uranium.

Labour Shortages

Leaving Loraine aside, the only other item of bad news was that the mines on the O.F.S. are facing a serious shortage of not only European labour but particularly of non-European labour, and it is clear that production targets will not be reached unless and until adequate labour becomes available during the year.

Extracts from the chairman's statements will be found on pages 26-30.

HARTIES' RECORD PROFITS

Neither a lower gold price—250s. per oz. against 250s. 10d. in November—nor the Christmas holidays prevented several of the newer mines from reporting expanded profits.

Hartebeestfontein's working profits reached a new peak of £397,000 against £364,000 in November. West Driefontein's profits advanced to the exceptionally high figure of £616,000 while Doornfontein continued to increase its earnings with a further rise to £170,000 against £159,000.

Free State Geduld, Welkom and Western Holdings announced better returns.

but those from the two Presidents, Harmony, and St. Helena, were lower.

Rand Leases were badly affected by an underground fire which occurred at the end of last month and a loss was shown of £212,000 against a profit of £5,000 in November. However, an insurance claim will be made out when the full damages have been assessed. An underground fire was also responsible for the loss of £17,000 reported by Simmer and Jack.

KAFFIRS ON THE MOVE?

Markets in London began the New Year in good style with prices rising in almost every section of the House, and on Wednesday, January 2, the *Financial Times Industrial Ordinary Index* stood at 180.4 compared with 177.9 on December 27. On the other hand, Wall Street started the New Year off in an erratic fashion and on January 2, the *Dow Jones Industrial Index* stood at 496.03 against 496.38 on December 27. The gold share market, which has shown indications of trying to go better in recent weeks, improved its all round position this week. As we go to press it is too early to know whether the market has thoroughly digested the Annual Reports of the five Anglo American O.F.S. Group mines and the monthly returns but the initial reaction was to put Welkom better on the annual report and Hartbeesfontein higher on the record level of monthly

profits. Coppers have been a fairly good market, with Rho-Kats prominent.

Tins showed narrow fluctuations. In lead/zincs, Rhodesia Broken Hill went ahead sharply after going ex-dividend. Lake George weakened on the poorer ore reserve position but St. John d'El Rey moved ahead to £3. Ashanti, the rich West African producer moved ahead presumably on hopes that encouraging news would soon be forthcoming concerning underground operations connected with the Eton Turner shaft.

RAILWAY AGREEMENT LIFTS COPPERBELT

*A traffic agreement has been signed and ratified between Rhodesia Railways and the Compagnie du Chemin de Fer du Bas-Congo au Katanga and the Benguela Railway Company providing through railway freight rates from the Portuguese West African port of Lobito to the copper mines of Northern Rhodesia. This will enable Northern Rhodesia to take full advantage of its only rail link with the west coast. The agreement became effective on January 1. The agreement takes on more significance in the light of the joint statement of the copper mining companies protesting at the increase in the price of carrying copper from Ndola to Beira or Lourenço Marques. The companies claim that by doubling trans-

port costs the railways have added £10 per ton to the cost of producing the metal. This was a complaint that Sir Ernest Oppenheimer discussed in detail in the annual reports of his group.

Financial News and Results

Roan and Mufulira to Reorganize Their Capital Structures.—Roan Antelope Copper Mine and Mufulira Copper Mines have announced a scheme for the reorganization of their respective capitals. In the case of Roan this will involve the capitalization of reserves for the issue to holders on January 11, 1957, and to persons surrendering Coupon No. 35 from the Company's Stock and Share Warrants to Bearer of four new Ordinary shares of 5s. each, credited as full paid, for every five units of Ordinary stock or shares then in issue, fractions of new shares being ignored.

In the case of Mufulira it will involve the capitalization of reserves and the application of share opinions of the issue to holders on January 11, 1957, of four new ordinary shares of £1 each, credited as fully paid, for every five shares in issue.

Circulars from the above two companies giving details of the issue, together with a notice convening an extraordinary general meeting, will be issued to members as soon as possible.

(Continued on page 30)

LONDON STOCK EXCHANGE PRICES, JANUARY 2, 1957

[illegible]

Mining Personalities

Col. Sir Thomas Ellis Robins, K.B.E., who is taking up residence in England and has been elected a director of Barclays Bank D.C.O., has resigned his vice-chairmanship of the Bank's Rhodesian board, but will remain a member. Sir Andrew Strachan, C.B.E., has been appointed vice-chairman of the Rhodesian board. Sir Ellis is resident director in Rhodesia of the British South Africa Co., of which he is vice-president. We understand that on his return to Britain—the date of which has not been finally settled—he will become a member of the executive committee.

*

Lieut.-Col. R. L. Broad, M.C., has decided to return to the U.K. and has, therefore, resigned as chairman and director of Merchants' Industrial Corporation Ltd. and New Union Goldfields Ltd. and of their respective subsidiary and associated companies as from January 1.

He remains a member of the London Committee of the respective companies.

Mr. Martin Ellison Rich has been appointed chairman of the above-named companies.

*

The Rt. Hon. The Earl Castle Stewart, M.C., who is 67, is resigning from the Board of Mount Isa Mines Limited as from January 1, 1957, and also as Chairman of its English subsidiary, Britannia Lead Company Limited. Mr. W. R. B. Foster is succeeding him as chairman of Britannia Lead Company Limited.

*

Mr. R. B. F. Wylie has been appointed to the new position of director of the Copper Development Association. Mr. G. W. Preston has retired as general manager for health reasons.

*

Mr. E. Fraenkel has retired from the position of executive director of Union Corporation, Ltd., but retains his seat on the board. Mr. R. H. MacWilliam has been appointed a manager in London.

*

Mr. D. D. Forsyth, a former member of the Atomic Board of Control, has been appointed chairman of the commission on the application of nuclear power in South Africa. The commission will enquire into the desirability of establishing a nuclear power station or stations in the Western Cape and other areas remote from large coalfields.

*

Mr. H. G. Hall and Mr. T. Jeffery have been appointed joint liquidators of Ashanti-Obuasi Reefs.

*

Mr. H. W. Naish, director of establishments (finance), National Coal Board, retired at the end of 1956. The board are redistributing the functions for which his department is responsible between the staff, finance and industrial relations departments. Mr. Naish has accepted the board's invitation to become consultant on investments and a member of the Investment Advisory Panel, which considers the investment policy for the funds of the superannuation, pensions and other schemes.

*

Mr. E. Bruce Ball has resigned from the board of Metal Industries and from the boards of all subsidiary companies of which he was a director.

NATIONAL COAL BOARD

DURHAM DIVISION

PLANNING STAFF

Applications are invited for the following vacancies in the Area Production Departments:—

1. DEPUTY AREA PRODUCTION MANAGER (PLANNING)—NO. 6 (NORTH-WEST DURHAM) AREA

Salary Range £2,000-£2,850 p.a.

Applicants must possess a First Class Certificate of Competency and have held senior managerial posts. They should have had experience in planning and in supervision of reconstruction work above and below ground, and experience in the latest methods of mining, including face mechanization and modern transport layout. The successful applicant will be in charge of the Area Planning Department and will be responsible for the co-ordination of all the planning work in the Area. Please quote reference E.V. 143/66.

2. AREA PLANNING ENGINEERS—NOS. 1 (NORTH-EAST) AND 4 (SOUTH-WEST) DURHAM AREAS

Starting salary will be not less than £1,500 p.a.

The successful applicants will be responsible to the Deputy Area Production Manager (Planning) for the direction, supervision and co-ordination of general planning work in the Area. A heavy load of reconstruction work is in progress and contemplated. Please quote reference E.V. 144/66.

3. SHORT-TERM PLANNING ENGINEER—NO. 1 (NORTH-EAST DURHAM) AREA

Starting salary will be not less than £1,200.

The successful applicant will be responsible to the Area Planning Engineer for the direction, supervision and co-ordination of short-term planning work within the Area. The Area has a large development programme ahead of it, much of it in undersea workings. Please quote reference E.V. 145/66.

4. SENIOR PLANNING ENGINEERS—NOS. 3 (SOUTH-EAST) AND 4 (SOUTH-WEST) DURHAM AREAS

Starting salary will be not less than £1,200.

The successful applicants will be responsible to the Area Planning Engineer for the direction and supervision of detailed planning and draughtsmanship. Please quote reference E.V. 146/66.

5. PLANNING ENGINEERS—NOS. 1 (NORTH-EAST) AND 4 (SOUTH-WEST) DURHAM AREAS

Starting salary will be not less than £1,200.

The successful applicants will be responsible to the Area Planning Engineer, mainly on mining projects of a major nature. Please quote reference E.V. 147/66.

6. PLANNING ENGINEERS—NOS. 2 (MID-EAST) AND 6 (NORTH-WEST) DURHAM AREAS

Starting salary will be not less than £950.

The successful applicants will be responsible for detailed planning within Planning Groups, mainly in connection with short-term planning and face layout. Please quote reference E.V. 148/66.

7. PLANNERS—NOS. 4 (SOUTH-WEST), 5 (MID-WEST) AND 6 (NORTH-WEST) DURHAM AREAS

Starting salary will be not less than £750.

The successful applicants will perform planning tasks under the supervision of the Area Planning Engineer (or the Senior Planning Engineer, if in post). Please quote reference E.V. 149/66.

APPLICATIONS, stating full particulars of age, education, qualifications and experience, should be submitted within 7 days of publication to:— Divisional Chief Staff Officer, Staff Department, National Coal Board, Durham Division, 7 Side, Newcastle upon Tyne, 1.

Applicants for more than one post should submit separate applications, stating their preference of Areas where applicable.

ANGLO AMERICAN CORPORATION OF SOUTH AFRICA LIMITED

(Incorporated in the Union of South Africa)

GOLD MINING COMPANIES IN THE ORANGE FREE STATE

(All companies mentioned are incorporated in the Union of South Africa)

Extracts from the Statements by Mr. H. F. OPPENHEIMER, Chairman of the Companies,

issued with the Annual Reports for the year ended September 30, 1956

PRESIDENT BRAND GOLD MINING COMPANY LIMITED

THE continued rise in profits has enabled the Company to declare dividends for the year totalling 3s. 6d. per stock unit, compared with the maiden dividend of 1s. per stock unit declared last year. In addition, the balance of £600,000 owing on the original £1,250,000 loan from Welkom Gold Mining Company, Limited, has now been fully discharged.

The progressive improvement in operating results was achieved in spite of a temporary setback in April, when fire broke out in the workings at no. 1 shaft. The monthly tonnage milled was stepped up from 50,000 tons in September, 1955, to 60,000 tons in September this year, and although there was a gradual decline in the monthly grade of gold declared from 16.01 dwts. in September, 1955, to 15.34 dwts. per ton in September, 1956, the profit per month advanced from £335,570 to £383,145 over the same period. In addition, a small but satisfactory reduction was effected in the working costs per ton milled, which averaged 66s. 11.72d. per ton milled for the year under review, compared with 69s. 1.88d. for the previous financial period.

The loan facilities of £1,250,000 previously granted to the Company by the Anglo American Corporation of South Africa, Limited, will remain available until December 31, 1956, when they will be reduced to £250,000. Capital expenditure during the year was £1,434,720 which included £997,813 spent on shaft sinking, development and equipment and £291,000 on excess development. The expenditure incurred on shaft sinking included amounts expended in respect of the Company's no. 2 sub-vertical twin circular shafts and the Company's portion of the cost of the Welkom company's no. 3 joint ventilation shaft system.

The active development programme carried out during the year is evident in the considerable footage driven on reef, which has added 928,000 tons to the ore reserve, bringing the estimated payable reserve to 2,501,000 tons. The estimated stope width has decreased by 1.77 inches

to 48.15 inches, and the average assay value of the ore reserve, at 17.96 dwts., reflects a slight drop of 0.19 dwt. compared with the value in September last year. This drop is to be expected, since development is no longer confined to the richer areas in the vicinity of no. 1 shaft, which was of necessity the case in the early stages of production. As development expands into other sections of the mine, the average development values may be expected to become relatively lower; the decrease so far has been slight, and it should be gradual, but increased tonnages milled and improved mining efficiencies should nevertheless ensure a steady and continued rise in profits.

No. 2 Shaft Area

At present, about four-fifths of the tonnage sent to the mill is drawn from no. 1 shaft. In order to bring about a better balance between operations at this shaft and no. 2 shaft, stoping operations are being intensified in the no. 2 shaft area and work is proceeding as rapidly as possible there, to make additional stope faces available. It is likely, however, to take some considerable time before this shaft will be in a position to contribute its full proportion, as the greater portion of the area to be served by no. 2 shaft lies at depths below the lowest working level of this shaft.

Satisfactory progress has been made in the sinking of the no. 2 sub-vertical shaft system on the mine. The system is being sunk from the 4,600 foot level, which is the bottom working level of the existing no. 2 shaft, and is planned to facilitate mining to a depth of approximately 7,000 feet. Underground airways, haulages and hoist chambers were completed for the 18-foot diameter sub-vertical ventilation shaft, and sinking had reached a depth of 601 feet below the collar by the end of November. Preliminary work is also well advanced on the nearby 24-foot diameter hoisting shaft.

Steady progress has been made in sinking operations at the no. 3 joint ventilation shaft system on the property of Welkom mine, in which our mine will

have a share in the ventilation capacity with Welkom and President Steyn. By the end of November, 4,017 feet had been sunk in the 18-foot diameter ventilation shaft, and 839 feet in the 24-foot diameter hoisting shaft. The 46 haulage north from no. 1 shaft on our mine has been advanced a considerable distance towards the Welkom boundary, so that a connection can be effected with the Welkom shaft system as soon as the time is opportune.

The treatment of residue slimes from our Company's reduction plant for the extraction of uranium has continued very satisfactorily during the year and the profit from this source amounted to £397,044 for 1956, compared with £148,772 for the nine months ended September 30, 1955.

Uranium Production

The Company participates in a uranium production scheme with the other four mines in the Welkom area administered by the Anglo American Corporation, and Freddie's Consolidated Mines. Under the scheme, uranium slimes of an economic grade have been treated in the plants situated on the properties of President Steyn and of Welkom Gold Mining Company. As announced in June, Loraine mine has now been accepted as a uranium producer and to provide for its inclusion, the existing scheme for the treatment of uranium slimes has been revised. The agreement dealing with the new joint uranium production scheme came into force on October 1, 1956. The extensions to the uranium plants on the President Steyn property and on the property of Welkom are well in hand and when complete, each plant will have a treatment capacity of 150,000 tons per month. Both plants should be operating at the full extended capacity in the second half of 1957.

At present the mine is facing a shortage not only of European labour but particularly of Non-European labour. Every effort is being made to bring about an improvement in the position, but it is clear that production on the mine must inevitably suffer, unless adequate labour can be made available.

FREE STATE GEDULD MINES LIMITED

THE Company commenced production in January, 1956, and encouraging operating results were achieved in the remaining nine months of the financial year. Despite the difficulties encountered with underground water and faulting, great strides have been made in attaining a steady increase in profits.

In January, the first month of production, 33,000 tons were milled, the profit being £20,168; by September, the monthly tonnage milled was 45,500 and

the profit had risen to £80,229. The fact that there has been a steady rise in the scale of profits earned from month to month during the year on the basis of the relatively limited tonnage available, is a strong indication of the rich potentialities of this mine.

Improved Yield

Since the mine came into production, the monthly declared yield has improved by almost 2 dwts. to reach 8.49 dwts. per ton in September. This yield will be

further improved when, with the attainment of a better balance in mining operations at the two shafts, greater tonnages are drawn from certain sections of the no. 2 shaft area where higher reef values have been revealed in development sampling.

The active development policy pursued during the year is reflected in the ore reserve calculated at September 30, amounting to 1,264,000 tons, with an estimated value of 16.15 dwts., and stope width of 46.60 inches.

Good progress has been made in development north of no. 1 shaft, although the values obtained thus far, while satisfactory, have not been as good as those disclosed to the south of the shaft. Haulages are being driven south of the shaft to open up the south-western section of the mine, and whilst this development has been retarded by having to commend with complex faulting and water, fair progress has been achieved. The average value of the reef development in the no. 1 shaft area was 551 inch-dwts., which compares favourably with the average value of 485 inch-dwts. disclosed in development for the previous financial period. Work is proceeding as rapidly as possible to open up the promising area to the south and south-east of the shaft.

In the area of no. 2 shaft a considerable footage was developed during the past year and a limited amount of stoping has been possible. Consistently high values have been recorded in the area south of the "major east-west fault zone," referred to in the quarterly reports as the "water-bearing zone." This is a broad zone running roughly east to west some 900 feet south of no. 2 shaft, where large quantities of water have been encountered. Good values have come from development north of this zone, but particularly promising are those exposed to the south of it, where 28,000 feet had been developed from the 43 and 45 levels up to the end of September. Of this total, 3,785 feet of Basal Reef were sampled, averaging 2,018 inch-dwts., with 100 per cent. payability. These values are extremely encouraging and during the coming year it is planned to penetrate the zone with additional haulages on the 47, 49 and 51 levels.

During June, the 43 level haulage, advancing southwards from no. 2 shaft, and the Western Holdings 41 level haulage, advancing northwards, holed

some 1,000 feet north of the Western Holdings boundary. Of the development which was accomplished in the vicinity of the holing 475 feet was sampled, all of which proved payable, with average values of 1,911 inch-dwts. The principal purpose of the work by Western Holdings was to explore the reef for our Company in the area north of the Western Holdings boundary. It is not proposed to commence stoping in this locality for the time being, due to its remoteness from the shaft and the present difficulty of providing adequate ventilation. As I have indicated, results in the area south of the major east-west fault zone and more adjacent to no. 2 shaft are so eminently satisfactory that the present availability of stope faces there will dictate that in preference, mining should proceed with all speed in that area.

As the major portion of development in the no. 2 shaft area will be concentrated in the area south of the major east-west fault zone, it is not proposed to continue the practice whereby the results obtained from this area are stated separately in the quarterly reports; they will instead be included in the aggregate results for development at no. 2 shaft.

Two further holings were effected during the year: in January, no. 2 shaft was connected with a haulage on 53 level from no. 1 shaft, providing improved ventilation conditions and permitting an increased deployment of underground labour; while in June, a connection was made between the no. 1 shaft and the no. 3 shaft (previously known as Freddie's South no. 2 shaft).

Finance

As I mentioned in my review last year, it was intended that expenditure during the year should be financed by drawing on the loan facilities of £4,500,000 granted to the Company by Anglo

American Corporation of South Africa, Limited, until arrangements could be made to raise further long-term finance. In June, it was announced that the directors were of the opinion that conditions were not propitious for a share issue and that it would be in the interests of the Company to continue to finance operations by means of a loan fixed for a number of years.

Arrangements were accordingly made whereby Anglo American Corporation, in consideration for granting the Company loan facilities of £5,000,000 until December 31, 1960, will receive the right on December 31, 1957, to subscribe for 497,346 shares in the Company at a price of 80s. per share. Members registered on the same date and holders of bearer warrants will receive the right to subscribe for the remaining 703,900 reserve shares in the Company in the proportion of two new shares for every 25 shares held, at the same price of 80s. per share. In terms of these arrangements concluded with the Corporation, the loan facilities of £5,000,000 will be reduced by such amounts as may be received by the Company from the exercise of these rights.

Capital expenditure during the year, financed largely by drawings on the loan facilities granted by Anglo American Corporation amounted to £1,919,798, which includes £574,000 incurred on excess development.

Although the Company has been accepted as a uranium producer, the uranium values disclosed thus far do not indicate that a profit can be derived from the treatment of its residue slimes at this stage. The Company has, however, become a participant in a joint uranium production scheme, whereby it will be entitled to certain treatment facilities at the plants on the properties of Welkom and President Steyn mines, should the grade of its uranium slimes become economic.

WESTERN HOLDINGS LIMITED

AS a result of successful mining operations, dividends were declared during the year totalling 3s. 6d. per share, as compared with the maiden dividend of 1s. 6d. per share paid last year. The increased revenue resulted from a substantial increase in the tonnage milled and a consistent improvement in the grade of ore sent to the mill; monthly profits rose from £158,600 in September, 1955, to £240,000 in September this year. Capital expenditure for the year was £1,311,958. This included £1,098,793 incurred on shaft sinking and equipment, and £213,000 on excess development. This expenditure was financed partly from profits, and partly from drawings on the loan facilities of £2,000,000 granted to the Company by Anglo American Corporation of South Africa Limited. A review of the Company's financial position has indicated that the full amount will not be required, and Anglo American Corporation has, at our request, reduced the facilities to £1,500,000 which is likely to be adequate for our Company's requirements.

Improved Milling Rate

The rate of milling now shows an improvement of 16,500 tons per month over the milling rate in September, 1955. By the end of November milling had reached 88,000 tons per month, and the present general improvement in the

availability of stope faces and in the ore reserve position indicates that, provided an adequate supply of labour is available, the mine is likely to be milling at a rate approaching 100,000 tons per month by the end of 1957.

Excellent progress was maintained in development during the year, which added some 800,000 tons to the ore reserve, bringing the estimated payable reserve to 3,673,000 tons as at September 30, 1956. Compared with the ore reserve at September 30, 1955, the average assay value has increased by 0.45 dwt. to 11.26 dwts., while the estimated stope width has been reduced by 1.05 inches to 45.84 inches.

The improved values from reef development influenced the grade of ore milled during the year, and the yield has shown a rise from 7.50 dwts. per ton in September, 1955, to 8.85 dwts. per ton in September this year. An encouraging trend of higher values from more recent development sampling is also evident in the enhanced value of the ore reserves.

During June, the 41 haulage which was driven due north from the no. 1 shaft into the property of Free State Geduld, was connected with the 43 haulage south of that company. Underground ventilation arrangements made it more practicable for this Company to continue development on behalf of Free State Geduld in the area immediately north of the common boundary, but this

work has now been discontinued, as sufficient development has been completed for the purposes of Free State Geduld.

Previously, the only connection between the two shafts on our mine was the haulage on 43 level. A further connection was recently made with haulages on 36 level and in the near future haulages on 38 level will also be connected. These inter-shaft connections assist in the distribution of air underground, and in addition, help to elucidate the faulting in the centre of the mine. Work will now proceed to open up this central area on the lower levels.

Two twin haulages on 43 level have been headed into the eastern portion of the lease area, one from no. 1 shaft, the other from no. 2 shaft. They will advance in the general direction of the surface boreholes M.2. and D.1. respectively, and should provide valuable information about faulting and the position of the reef between nos. 1 and 2 shafts and the eastern boundary, which will assist in the formulation of mining policy for this area of the mine.

Promising Values

Development has proceeded satisfactorily in the area of no. 2 shaft, particularly promising values having been disclosed in the region south of the shaft.

Sinking operations on the no. 3 shaft system, planned to open up the western

portion of the Company's property, are under way. Twin circular shafts are being sunk to provide, in the 24-foot diameter shaft, hoisting and downcast ventilation capacity and, in the 18-foot diameter shaft, upcast ventilation.

Since the completion of the initial 1,500 feet, the rate of sinking has been retarded by the intersection of water-bearing fissures, but by November 30, 2,846 feet had been sunk in the smaller ventilation shaft and preliminary work was nearing completion to allow sinking to begin in the larger hoisting shaft. In addition, certain development footage for stations and pump chambers at various levels had been completed in the ventilation shaft.

The completion of the no. 3 shaft system, together with the necessary development in the western area, should place the mine in a position to mill at the

rate of 150,000 tons per month, and when the time is opportune the necessary extensions will be made to the reduction plant, to increase the existing capacity of 125,000 tons per month.

The attainment of the milling target for the coming year will be largely dependent on the availability of labour. There is a grave shortage of manpower which is common to the industry, and although every effort is being made to bring about an improvement in the position, the problem continues to be a national one, confronting not only the mines but nearly every industrial enterprise in the country. It is clear that production on the mine must suffer, unless adequate supplies of both European and Non-European labour can be made available.

Although our Company has been accepted as a uranium producer, the

uranium values disclosed thus far do not indicate that a profit can be derived from the treatment of its residue slimes at this stage. The Company has, however, become a participant in a joint uranium production scheme, whereby it will be entitled to certain treatment facilities at the plants on the properties of Welkom and President Steyn mines, should the grade of its uranium slimes become economic.

Additional obligations and liabilities have been imposed on the mining industry by the Pneumoconiosis Act, which became law during the year, superseding the Silicosis Act. The increased levies under the new legislation have already been reflected in the higher working costs incurred during the last quarter, and will add to the task of keeping working expenditure to a minimum.

WELKOM GOLD MINING COMPANY LIMITED

THE income and expenditure account reflects a surplus for the year of £261,428. The unappropriated profit carried forward to 1957 was £200,067. Capital expenditure amounted to £1,213,258, of which £1,078,063 was incurred on shaft sinking and equipment, and £36,000 on excess development. From the beginning of June, 1956, all development has been charged to working costs. The major portion of the capital expenditure was financed by drawings on the long-term loan facilities granted by Anglo American Corporation of South Africa, Limited, and the amount drawn on these facilities at September 30, 1956, was £1,714,947.

There has been a greater overall improvement in operating results this year than in any previous year. The working profit of 3s. 6d. per ton milled for the quarter ended September 1955 reached 12s. per ton milled for the quarter ended September 1956, thus substantially increasing the margin between revenue and costs.

This encouraging picture is further enhanced by the possibility that the company may soon be in a position to derive profits from uranium, if the uranium values disclosed in recent development are sustained.

The marked rise of monthly profits from £16,000 to £55,000 between the first and last months of the financial year has been due to a steady improvement in the yield per ton milled and to a progressive though moderate advance in the milling rate. Unfortunately periodic shortages of labour retarded the rate at which milling could be increased, and the attainment of an even better milling target for the coming year will be largely dependent on the availability of labour. There is a grave shortage of manpower, and although every effort is being made to bring about an improvement in the position, production on the mine must undoubtedly suffer, unless adequate labour can be made available.

Record Yield

The general improvement in the trend of development values, has favourably influenced the average yield of ore mined during the last twelve months, the yield increasing from an average of 3.96 dwts. per ton in 1955 to an average of 4.45 dwts. per ton this year. This represents the highest average annual yield yet recorded on the mine.

By pursuing a vigorous development programme during the year, some 995,000 tons have been added to the ore reserve, now totalling 3,350,000 tons. While the estimated value of the ore reserve has increased by 0.37 of a dwt. to 6.30 dwts., the estimated stope width has decreased by 1.72 inches to 48.19 inches.

Despite intermittent delays caused by intersections of water-bearing fissures, President Steyn Gold Mining Company has made good progress on the 42 level haulage which it is driving, on behalf of our Company, into the south-eastern section of our lease area. At November 30, the haulage had advanced 943 feet beyond the common boundary. The haulage is being driven in the footwall, and as yet no crosscuts have been turned off to intersect the reef, but in due course valuable information should be provided from this area which will assist in the long-term planning of future operations in the south-eastern portion of this Company's property.

Excellent progress has been made in the sinking of the Company's no. 3 joint shaft system. President Brand and President Steyn mines will share in the ventilation capacity of this system, and are contributing a proportion of the capital cost. A depth of 4,017 feet had been reached in the smaller 18 ft. diameter ventilation shaft by the end of November and 839 feet in the larger 24 ft. diameter hoisting shaft.

Valuable benefits will flow from the completion of the new shafts. The additional shaft system will permit tonnages in excess of 100,000 tons per month to be milled. Equally important, is the prospect of an improved grade of ore from the south-western triangle of the Company's lease area, where the reef, inaccessible from the existing workings, but which can be exploited from the new shaft system, is expected to be of higher value than the average so far exposed in the mine.

It is planned to sink the new shafts to a depth of 4,500 feet and, if all goes well, sinking of both shafts should be completed by the middle of 1958. Development will then have to be accomplished in the area served by the shafts, before stope tonnage can be drawn to supplement ore from the existing no. 1 and no. 2 shafts. The present capacity of the gold reduction plant is

125,000 tons per month, which will be able to cope with the increased tonnages.

Uranium Prospects

The improvement in uranium values obtained in development indicates that our mine can expect to commence deriving profits from this source possibly during the second half of 1957. The installation of the equipment for pumping slimes between the gold reduction plant and the uranium treatment plant has already been put in hand, and by the time it is completed it is likely that the grade of uranium will be sufficiently high to warrant treatment.

Our Company participates in a uranium production scheme with the other four mines in the Welkom area administered by the Anglo American Corporation, and Freddie's Consolidated Mines. Under the scheme, uranium slimes of an economic grade have been treated in the plants situated on this Company's property and on the property of President Steyn.

In June, it was announced that Loraine mine had been accepted as a uranium producer, and to provide for its inclusion, the existing scheme for the treatment of uranium slimes has been revised. The agreement dealing with the new joint uranium production scheme came into force on October 1, 1956. The pipeline from the Loraine reduction works to link up with the existing pipeline from Freddie's to the uranium treatment plant on this Company's property was completed towards the end of October.

The extensions to the uranium plants on this Company's property and on the property of President Steyn are well in hand, and when complete, each plant will have a treatment capacity of 150,000 tons per month. Both plants should be operating at the full extended capacity in the second half of 1957.

It is proposed to institute a system of surface waste sorting at the mine early next year, which should have the effect of increasing the uranium head from residue slimes to be treated in the uranium plant. The elimination of waste rock by surface sorting has been practised at the Loraine mine with considerable success, and the introduction of similar methods at our mine should bring about a useful reduction in the milling width and a higher potential of profits which can be earned from uranium.

PRESIDENT STEYN GOLD MINING COMPANY LIMITED

THE results of operations on the mine during the period under review have shown a most satisfactory improvement, which has enabled the Company to declare total dividends for the year of 1s. 9d. per share. This compares favourably with the maiden dividend of 6d. per share declared last year. In addition, an amount of £925,000 has been appropriated to meet the repayment of the balance of the loan of £1,250,000 borrowed from Welkom Gold Mining Company, Limited.

Capital expenditure during the year amounted to £637,922 which includes £19,000 incurred on excess development. From the beginning of February, 1956, all development has been charged to working costs.

Steady progress has been achieved in operations. While monthly milling has risen from 80,000 tons in September, 1955, to 94,000 tons in September this year, there has also been a substantial increase in monthly profits, from £154,482 to £225,800 over the same period.

Milling Prospects

The mounting milling rate suffered a temporary setback in October of the current year when a fire occurred in the workings at no. 2 shaft, but despite this, there is a fair prospect that the mine will be able to increase its milling to 100,000 tons per month, possibly by the end of 1957. This target will be dependent, however, on the availability of additional labour. There is a grave shortage of manpower, common to all mines in the industry. Although every effort is being made to bring about an improvement in the position, production will undoubtedly suffer, unless adequate labour can be made available.

The prerequisite of an increased milling target is the availability of adequate stope faces. This has been assured by the considerable development footage accomplished during the year, which has added 577,500 tons to the ore reserves of the mine, bringing the estimated payable reserve to 3,102,000 tons. The average assay value of the ore reserves,

compared with the value for last year, has increased by 0.38 dwt. to 8.87 dwts., while the estimated stope width has been reduced by 1.00 inch to 47.12 inches. The sound position created by the substantial ore reserves now available, makes it possible to reduce slightly the scale of development operations, thus releasing a proportion of the labour force formerly on development work for stoping.

During the year extensions to the treatment section of the reduction plant were completed, and the plant is now in a position to mill at a capacity of 125,000 tons per month.

The average grade of ore milled has risen from 6.79 dwts. per ton during 1955 to 7.51 dwts. per ton for the year under review. While the trend of development values disclosed by sampling during the year is such that no major improvement in the milling grade can be expected during 1957, every endeavour will be made to step up tonnages milled and to increase working efficiencies in order to sustain a steady advance in profits.

Development is continuing in the haulage from no. 1 shaft on 42 level, which has now crossed our northern boundary into the Welkom lease area, at the request of that company. This development has helped to demarcate faulting in the region north of our no. 1 shaft, and further haulages will be driven northwards to explore the area.

"A" Reef Development

A certain amount of development footage has been accomplished on the Leader reef and on the "A" reef during the year. Although the Leader reef has so far shown a low percentage of payability in regard to gold content, its uranium values are encouraging. In addition, promising gold values have been obtained from the relatively small footage sampled on "A" reef. When greater footages have been exposed on these reefs, it should be possible to attempt a long term assessment of their economic value to the mine.

I have referred in previous reviews to the participation by the Company with

Welkom Gold Mining Company, and President Brand Gold Mining Company, in the sinking of the no. 3 shaft system in the southwestern section of Welkom's property. Good progress has been made in sinking operations: by the end of November 4,017 ft. had been sunk in the 18 ft. diameter ventilation shaft, and 839 ft. in the 24-ft. diameter hoisting shaft. A haulage from the workings northwest of no. 1 shaft on our mine will ultimately connect with the no. 3 shaft system, and the additional ventilation will make possible an increased milling rate and a development programme to open up the areas to the west of our no. 1 shaft. The new shaft system will be sunk to a depth of 4,500 feet and our mine should be deriving the benefit of the additional ventilation by the middle of 1958.

Uranium

The treatment of this Company's residue slimes for the extraction of uranium has continued very satisfactorily, and the profit from this source amounted to £692,790 for the year compared with £235,288 for the nine months ended September 30, 1955.

Our Company participates in a uranium production scheme with the other four mines in the Welkom area administered by the Anglo American Corporation, and Freddie's Consolidated Mines. Under the scheme, uranium slimes of an economic grade have been treated in the plants situated on the property of this Company and of Welkom Gold Mining Company. As announced in the Press last June, Loraine mine has now been accepted as a uranium producer and to provide for its inclusion, the existing scheme for the treatment of uranium slimes has been revised. The new joint uranium production scheme came into force on October 1, 1956.

The extensions to the uranium plants on this Company's property and on the property of Welkom mine are well in hand, and when completed, each plant will have a treatment capacity of 150,000 tons per month. Both plants should be operating at the full extended capacity in the second half of 1957.

LORAINÉ GOLD MINES LIMITED

CAPITAL expenditure during the year amounted to £813,290 which includes £607,000 incurred on excess development. This expenditure has been financed by drawings on the loan facilities granted by Anglo American Corporation of South Africa, Limited, of which £3,569,732 had been drawn by September 30, 1956. The loan facilities comprise £2,750,000 available until December 31, 1962, and a further special loan of £1,250,000 available until December 31, 1956. The Corporation has agreed, as you are aware, to treat all drawings on the total facilities of £4,000,000 as interest free for the period December 1, 1955, to December 31, 1956, when the matter will be reconsidered.

The mine has now been in production for seventeen months, and in this period we have been able to gain a somewhat broader picture of its problems and potentialities than was the case at the time of my previous review. The operating and development results have been watched with the closest interest and not without some anxiety, and I am pleased to say that to some extent there has been

an improvement in the position of the mine for the period under review.

The monthly tonnage milled increased from 40,500 tons in September, 1955, to 58,000 tons in September of this year. The declared loss per month was reduced from £28,181 to £8,088 during the same period.

Because of the occurrence of a shale band closely overlying the reef in most parts of the mine, which would cause the stoping width to be excessive if normal undercutting were employed, the semi-resue method of mining has been employed where necessary, with great success. This method of mining has reduced the quantity of waste which has to be hoisted, and coupled with the elimination of waste amounting to approximately 18 per cent, by surface sorting at the reduction plant, this technique has made it possible to maintain the average milling width below 38 inches. This is a highly creditable achievement.

Ore Reserves

Development has been maintained at approximately 8,000 feet per month, re-

sulting in an improvement in the ore reserves of the mine, which have increased by nearly 600,000 tons to 1,101,800 tons as at September 30, 1956, with an average value of 4.19 dwts. over a stope width of 44.41 inches. Compared with the average value last year, there is an increase of 0.14 of a dwt. in the grade of the ore reserve; at the same time the estimated stoping width has increased by 4.29 inches. These results have been influenced, however, by the inclusion in this year's ore reserve of 239,400 tons on the "B" reef horizon at an average assay value of 6.77 dwts. over a stope width of 48.00 inches.

Development is being carried out down the dip on the Basal reef in the direction of the boreholes T.D.1 and K.2, with the object of discovering to what extent the area lying west of existing development and up to the boreholes carries values consistent with the encouraging results obtained by surface drilling some years ago. Considerable importance attaches to the results of this exploration. So far the sub-incline shafts and the winzes sunk into this area have not disclosed values

approaching those of the boreholes, but it will be some little time before the whole zone in the neighbourhood of the two boreholes have been adequately explored.

"B" Reef

On the "B" reef horizon, substantial footages have been developed. The average values are generally speaking, higher than those of the Basal reef and occasionally some exceptionally high values have been encountered; but, unfortunately, our experience up to now has been that such enrichment does not persist over any appreciable distance. The stoping which has so far taken place on this reef has proved that long continuous stretches of value rarely, if ever, occur and close supervision has to be exercised in mining operations in order to avoid excessive dilution from ore of little value.

While recognizing the importance of development on the "B" reef to the future of the mine, caution should at this stage be exercised before placing too great an emphasis on the "B" reef values thus far disclosed.

The future of the mine depends on an improvement in the present grade of ore

mined. By increasing the proportion of stope tonnage from the "B" reef horizon, it may be possible to attain a higher grade, but as I have already indicated, it is too early to predict whether overall good values can be sustained, owing to the highly erratic nature of the gold occurrence in this reef. Uranium values of an economic grade have unfortunately thus far not been associated with the "B" reef.

While every effort is being made to increase the milling rate as rapidly as possible, to prospect those areas where reef values appear to give most promise, and to maintain the high level of efficiency and economy which has been achieved on the mine, it is not possible at this stage to forecast the future profitability of mining operations on this property.

A twin crosscut is being advanced on 48 level in a south westerly direction from no. 2 shaft, towards the borehole K.1 and subsequently towards the Van den Heever's Rust area to be exploited by the Riebeeck Gold Mining Company; the cost of this development being shared with that company. This crosscut will

enable information to be obtained about the "B" reef, and the so-called "Rain-bow reefs" disclosed in boreholes in the Van den Heever's Rust area and in borehole K.1 on our property. At the end of November the crosscut was 2,221 ft. short of the K.1 borehole.

Uranium Production

The Company, having been accepted as a uranium producer in June this year, is now a participant in a joint uranium production scheme with the five mines in the Welkom area administered by the Anglo American Corporation, and Freddie's Consolidated mine. The pipeline from our company's reduction works to link up with the existing pipeline from Freddie's to the uranium treatment plant on the property of Welkom was completed towards the end of October, and if economic uranium values from the Company's slimes are sustained, it may be possible to commence deriving revenue from this source by the end of 1956.

The agreement dealing with the administration of the joint uranium production scheme came into force on October 1, 1956.

Copies of the Reports and Accounts of the above-mentioned companies may be obtained from the London Secretaries of the Companies — Anglo American Corporation of South Africa Limited, 40 Holborn Viaduct, E.C.1.

Company News and Results—Continued.

Crown Mines.—Crown Mines has announced that owing to the marginal profit at which the mine as a whole has recently been operating and to the progressive exhaustion of ore reserves in the Lower Eastern and Lower Central portions of the mine, it has been decided to cease mining in these areas in the near future. In order, at the same time, to take such other remedial action as may be considered advisable to safeguard the future of the mine without undue delay, it has been necessary to give formal notice to the government, in terms of Section 8 (1) of the Precious and Base Metals Amendment Act, 1926, of the company's intention materially to curtail its operations in the near future.

Bisichi Bids For Naraguta Tin.—The Bisichi Tin Company (Nigeria) has made a firm offer of four shares of 2s. 6d. each for every five shares of 10s. each in Naraguta Tin Mines Ltd., plus 1s. in cash. The Bisichi shares to be allotted under the offer will not be entitled to any dividend which may be declared by the Bisichi in respect of its financial year ended December 31, 1956.

The offer is dependent upon 90 per cent acceptance by Naraguta shareholders or such lower percentage as Bisichi may decide; and is subject to the consent of the Board of Trade, and to the Stock Exchange, London, granting a quotation for the new shares.

Further details will be communicated to shareholders in due course.

Clutha River.—Clutha River Gold Dredging has proposed that its capital be reduced from £225,000 in 2,250,000 shares of 2s. to £166,666 13s. 4d. divided into 2,000,000 shares of 1s. 8d. This would be effected by cancelling 250,000 unissued shares of 2s. each and by repaying to the holders of 2,000,000 issued shares 4d. paid up capital on each share. The nominal amount would thus be reduced to 1s. 8d. Balance sheet figures of Clutha River at March 31, 1956, revealed total assets of

£221,263 against £227,957 previously. Current assets of £162,385 exceeded current liabilities and provision for tax by as much as £150,000. Net profits earned during the past financial year declined to £2,514 from £5,515. An unappropriated balance of £3,790 compared with £4,714. Mr. F. G. Payne is chairman.

Outlook from North Broken Hill.—In his statement to shareholders of North Broken Hill Mr. M. H. Baillieu, the chairman, reported that the current financial year had started satisfactorily. Although grade recovered had been somewhat lower production was up. Moreover, prices realised for the company's products compared well with those during the opening months of the preceding year.

With increasing world trade and the great industrial expansion which was going on in almost every country, Mr. Baillieu was optimistic about the long term future provided production costs could be kept in check. With regard to the immediate future, however, the present state of world affairs made any prediction impossible.

Christmastime: Once again *The Mining Journal* received at Christmastime a delightful variety of calendars, Christmas cards and diaries from friends and well-wishers. We would like to acknowledge the good wishes for the New Year received from the following: Atlas Copco; Anderson, Boyes and Co. Ltd.; British Geon Ltd.; British Insulated Callender's Cables Ltd.; The British Tyre and Rubber Co. Ltd.; The Brush Group; The Butterley Co. Ltd.; Caterpillar Tractor Co. Ltd.; Climax Rock Drill and Engineering Works Ltd.; Cyprus Government Office; Denver Equipment Co. Ltd.; Edwards High Vacuum Ltd.; Holman Bros. Ltd.; International Harvester Co. of Great Britain Ltd.; Mavor and Coulson Ltd.; The Mond Nickel Co. Ltd.; Jack Olding and Co. Ltd.; Padley and Venables Ltd.; The Photographic Survey Corporation

Ltd.; Ruston-Bucyrus Ltd.; Steel King; Stewarts and Lloyds Ltd.; Richard Sutcliffe Ltd.; Westfalia Lünen; Hugh Wood and Co. Ltd. We would like to take this opportunity of again wishing all our friends at home and abroad a Happy and Prosperous New Year.

The Proprietors of Patent No. 683712 for "Explosive Device" desire to secure COMMERCIAL EXPLOITATION BY LICENCE in the United Kingdom. Replies to Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

A LEADING GOLD MINING COMPANY in West Africa has vacancies for graduates in Mineral Dressing or Metallurgy as Junior Metallurgists. Opportunity for gaining experience of plant operations and research. Minimum salary £1,000 per annum depending upon qualifications and experience. Three months leave on full salary on completion of tour. Tours of fifteen months with free passages, quarters and medical attention. Staff Assurance Scheme. Write Box E7873 Whites, 72/78 Fleet Street, London, E.C.4.

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